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Contents.

	PAGE
Retrospective	527
Scientific Control in Motor Cylinder Founding	528
Ferro-Manganese	530
Institution of British Foundrymen	531
Notes from the Branches	533
Comparison of Birmingham Brass Factories	534
Gravimetric Method of the Determination of Phosphorus in Pig-iron	535
Engineering at the British Empire Exhibition	535
Costs in Iron and Steel Production	536
Catalogues Received	537
Trade Talk	538
Iron and Steel Markets	539
The British Cast Iron Research Association	540
Deaths	540
Company News	540
Contracts	540

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institution of British Foundrymen.

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Retrospective 1922,

The outstanding feature of the past year has been deplorable trade conditions coupled with extensive technical progress. Undoubtedly the technical progress shown can largely be attributed to the Birmingham Congress and Exhibition. This gave rise to the largest congress of foundrymen ever held in Europe. Papers were contributed from America, France and Belgium. Its international character was reinforced by the inclusion of the Presidents and other office-bearers of these associations.

Another important aspect has been the appointment of a Test Bar Committee by the Institution of British Foundrymen. They hope to publish an interim report early next year, and foreign countries are anxious to co-operate. Recognition of the international work of the Institution is shown by the number of foreign and colonial members gained this year.

The British Cast-Iron Research Association has published its first report. Obviously, one year is a totally inadequate period in which to show any striking results, and can be regarded as a seed-sowing period. Much spade work has been necessary, and with the appointment of Dr. Percy Longmuir as a full-time director, helped by suitable assistants, a good harvest should be reported by next summer. That its work and business-like methods are bearing fruit is shown by the fact that an enthusiastic Spanish foundryman is proposing to organise a similar association for his country.

An added impetus to those associated with the foundry has been given by the award of the Oliver Stubbs medal to Mr. F. J. Cook, a past-president of the Institution. No better choice could have been made, for the value of any honour becomes greater when the recipient is conscious of the calibre of the previous winners. A high standard has been set in the choice of Mr. Cook, and one worth imitating by everybody associated with British foundry practice.

Trade in the foundry industry has been poor during the last year, but better than 1921. Last month's Board of Trade returns showed that a distinct improvement had been registered, especially in the metallurgical industries.

The past year, too, saw the introduction of new types of moulding machines into Great Britain. Much of a revolutionary character has been prophesied from the results obtainable, and if they help the British founder to compete with the depreciated currency and the lower standards of living obtaining in some countries, then they should be welcomed in any foundry engaged on quantity production. How far this has been or will be fulfilled it is difficult to say, but one thing is sure, that if they are to be a success they must be approached with an open and constructive mind.

This year has seen a considerable gain in membership of the Institution, but a still greater gain in status. Its sphere is widening to take in non-ferrous foundry work, due, no doubt, to its leadership having been in the hands of Mr. H. L. Reason, the first President to be associated with this branch of the industry.

The new branch formed in the West Riding of Yorkshire has now been firmly established under the presidency of Mr. A. A. Liardet, and Mr. J. Hogg has been responsible for the equally good progress shown by the Burnley section of the Lancashire Branch. Judging from the number of unattached members residing in South Wales, it appears worth while to consider carefully the advisability of starting a branch at Cardiff. We feel sure that Mr. C. Jones, a past-president of the Institution, would lend his valuable support. As the major portion of the Institution's activities are centred in the branches, every effort should be made to extend this work by every possible means.

The closer international relations which have been established during the year have in no small measure been due to the visit of Mr. Oliver Stubbs and Mr. T. Firth to the States. Mons. Ronceray, too, has done much to co-ordinate international foundry well-being. The importance of this work cannot be exaggerated, as no country has a monopoly of brains.

XUM

Scientific Control in Motor Cylinder Founding.*

By G. H. Judd, A.M.I.Brit.F.

One often hears and reads arguments relative to the comparison of examples of founding of generations ago with those of our present-day productions, and usually to the detriment of the latter. Certainly, when we do have an opportunity of examining one of the good old examples of founding—they do not seem to have preserved any bad examples, but perhaps wasters were unknown in those days—we usually express our admiration of the product, and rightly so, but it is obvious that there were no such things as time factors in those days, and when one takes into account the speed at which castings of to-day have to be produced, the present-day productions are in advance of those of the older days. A small casting the modern motor cylinder supplies is as good an example of casting as can be found for comparison. The modern tendency to cut down the weight of this class of casting, combined with increasing intricacy of design, calls forth the best of all those concerned in the production of this article. Add to this, that the casting has to machine sound practically all over, a speck of dirt or slag, say on a valve seat, scrapping an otherwise good casting. It will be seen that this is a more difficult proposition than producing a casting for appearance only.

One is apt to associate the term "scientific control" with the part played by the works' chemist or metallurgist, but the scope of this term should be enlarged to include the core maker, moulder, examiner, and works chemist, as all are responsible in their respective spheres for the production of the finished casting, and each may exert scientific control in the part it produces.

As showing this interdependence, one may make up a perfect mould—the sort of mould, for instance, the foreman points to with pride when visitors intrude into his department—but if the wrong type of iron were used for the job a scrap casting would result, say from hardness or porosity and *vice versa*. Again, one may tap into the ladle what could be considered a perfect iron for the job—perfect, at least, as far as our present knowledge of metals goes—but if the mould should be dirty, badly rammed, or comes wrongly vented, a scrap casting would result. The foreman, by the way, is not so keen to show these sort of moulds.

Although giving due credit to the other departments concerned, it is proposed to concentrate on the part played by the works' chemist or metallurgist, as this is the part in which the author is intimately concerned, but before doing so the other sections will be touched upon.

Science in Core Making.

This includes the examination of materials, such as sand for firmness, linseed oil for paraffin and viscosity, treacle or the equivalent binder for thickness, or a rough viscosity test, as a varying consistency of this material has been proved to cause scrap in shape of collapsing cores during drying, and core gum is tested for solubility. When satisfied that the quality of materials to be used in the core mixtures is correct, the first step is to obtain a very thorough and efficient drying of the sand. A definite weight of sand—taken for ease of manipulation by box measurement—is mixed with known volumes of the various binders, the mixture being well mixed in the mill to ensure homogeneity. The cores, having been produced, are dried, not in coke stoves, which usually present difficulties of temperature control, but in gas stoves, where the required temperature can be attained within a definite period, and maintained uniformly for as long as is necessary, say for four hours at 450 deg. F. (230 deg. C.). One cannot give any really definite figure for this important operation of drying, as naturally a thin jacket core requires somewhat different heat treatment from a heavy cake-core. In modern cylinders the design is becoming increasingly intricate, which point is particularly evident during the production of many of the complicated cores which show a great tendency to distortion and buckling during the drying process, such defects being discovered when the cores undergo inspection and gauging.

The cores having been blacked—and this may appear at first sight to be a very minor operation, but it is, indeed, a very important operation, as a wrong or poor blacking mixture will nullify the effects of a good core by causing dirt and scabbing. No control has apparently been placed on what should constitute the "blacking up" mixtures, as they seem legion, but at least one can exert some control in one's own foundry. In the first place, the plumbago used in this mixing should be tested, as this material varies very much in quality. A standard having been set, it can be bought to. Good plumbago should be high in carbon and low in metallic oxides, alkalies, volatile matter and fusible ash, etc. Then a definite volume of water to known weights of plumbago, clay and treacle, should these constitute the mixture, is thoroughly mixed, and by efficient emulsifying is rendered homogeneous. As to the cores, when finished, these are finally gauged and inspected, and stored in a warm atmosphere until required.

Moulding Details.

Here, although different types of sand mixtures are used, the same remarks apply as to thorough milling and mixing of the various sands and binders. Particularly is it necessary to measure into the mill the various sands, say, as in the author's foundry, by box measurement, *i.e.*, using a suitable-size box of which the weight contents are known.

Control in Buying.

The practice of buying pig-iron to fracture is gradually dying out, and nowadays an up-to-date foundry issues a specification based on its experience and buys to this analysis and gets it—sometimes. As received, the pig-iron is stacked in truck loads, usually about 10 tons, and from 5 to 10 pieces are selected from a stack. These pieces are well scratch-brushed or sand-blasted to remove adhering loose sand and drilled on the fracture face, the drillings well mixed and submitted to a complete analysis; or, where time does not permit, to a partial analysis, usually for silicon and phosphorus. Should the iron not be reasonably near the specification it is rejected; but if within limits specified, the composition is entered on a stock card relative to that stack of pig-iron, which card contains all particulars, such as number, maker, weight, date received, etc.; and this card is then handed to foundry foreman, who then knows that the particular stack is available for use. This obviates iron being drawn upon of which no analysis or particulars are known. Coke is usually tested for ash content and sulphur, and an important point where such castings as cylinders are under cast and high temperatures of molten metal is required, the size is regulated, the largest sized coke available being preferred. Limestone and fluor spa, the usual fluxes, are occasionally tested to see if keeping up to an established standard.

Mixtures.

The points worthy of particular note in reference to mixture for the cylinders are:—

(1) Not to depend on one brand of pig-iron only, as even blast-furnaces make wasters, which wasters do not go back to the furnace as in the foundry, but are usually delivered to the customer. In other words, should one depend upon one brand of iron only, for if the maker strikes a bad patch, there arrives the possibility of being without suitable iron.

(2) Not too many irons on account of confusing the charger and loss of time in weighings.

(3) The charge must be so proportioned as to absorb the correct proportion of runners, risers and scrap castings so as to ensure that scrap does not accumulate unduly.

* A Paper presented before the Coventry Branch of the Institution of British Foundrymen.

(4) All quantities of pig-iron and scrap should be weighed and not guessed. This makes for correct analysis and saves waste, as guessing weights and putting only "shovelsful," leads to too much metal being put on.

(5) Pig-iron should be broken reasonably small, as too-large pigs tend to scaffolding in the furnace with consequent uneven melting. Cold metal may be also produced.

Melting.

Having charged up, the next important item is undoubtedly the regulation of the blast. In the cupola under the writer's notice, unfortunately, there is no apparatus for measuring the volume of air going into the furnace, but the next best thing is used—a water-pressure gauge for measuring the blast pressure. This helps at least to ensure a reasonably regular rate of melting and reasonably regular heat. The gauge is made of large dimensions, approximately 4 ft. high in the shape of a U-tube of ¾-in. bore and filled with a coloured solution to make it easily readable and noticeable to the furnace operator. When the bed has been blown hot and the melting commences, the valve on the blower is regulated to give the agreed pressure and is kept at this figure right throughout the blow, in the author's case about 6 ozs.

Casting.

This requires very little comment except to emphasise that the majority of cylinder moulds require the hottest of metal, and practice has also confirmed that casting ladles require to be scrupulously clean, especially must they be free from slag; with the result, about 4 crane ladles are used during the afternoon on account of their slagging up.

Testing.

There appears to be a great divergence of opinion as to the varying effects of the various elements in cast iron—and the works weekly journal substantiates this—and although we recognise the great effects the other elements have, rightly or wrongly, the foundry with which the author is associated depends on the silicon figure for its guide and makes provision for early knowledge on this point daily. One can readily understand that where such large numbers of cylinder moulds are put down daily through the agency of machine moulding, it is essential to supervise closely the metal. With this end in view about 4 test blocks are cast at various intervals during the blow.

The silicon and phosphorus figures taken from everyday practice, show that although mixtures may run fairly uniform, yet there is sufficient discrepancy to warrant more than one test only being taken. At end of the blow, the test-pieces are cooled, and 4 sets of drillings are taken and mixed and silicon determination started immediately. As the silicon content is taken as a most important guide for the work, to know this figure early for following days cast is imperative. As is known, the silicon content alters as the iron is melted and mixtures have been proved in our practice to lose from 0.15 per cent. to as much as 0.5 per cent.: the losses varying with the type of iron and the heat obtained during melting. By knowing the silicon content early, the scrap content which is usually a large percentage of the charge, is also known, and the mixture can be regulated accordingly and thus scientific control of the mixture from day to day is rendered possible.

Silicon Losses.

Using the same stacks of pig-iron it would hardly be supposed that the metal would so alter from day to day as to necessitate these changes, but the varying cupola losses of silicon on consecutive days shows the necessity for such slight alterations of mixture. This is shown in Table I.

Table I., showing the variations in silicon loss:—

	Sat. Sept. 19	Mon. Sept. 21.	Tues. Sept. 22.
Calc'd	2.03 silicon	2.06	2.04
Actual	1.60 ,,	1.60	1.75
Loss	0.43 ,,	0.46	0.29

Later on in the day other details such as sulphur, phosphorus, manganese and carbons are obtained, although for these details the writer usually takes a piece of broken cylinder, preferably a barrel portion, for the complete analysis.

To be able to aim at a definite analysis for the iron, it is essential to know all the changes that take place during the melting operations, so that the mixtures can be calculated accordingly.

Changes during Melting.

This, at first sight, appears quite an easy affair to ascertain. Summarised it appears to be, analyse, melt, analyse again, and it is accomplished; but when carried out under works conditions, the following special tests were carried out, which shows the difficulty of providing reliable data.

Experiment 1.—Eight cwts. of all pig-iron of a very uniform analysis were used, 10 pieces being selected off actual pigs put in. The iron was put on as last charge of the day's blow and the following analysis was obtained:—TC, 3.50; Mn, 1.00; P, 0.29; Si, 1.85; and S, 0.02 per cent.

It was tapped out of furnace, and the last 1 cwt. of metal was poured into a test-block and the partial analysis showed 0.10 per cent. S. and 0.46 per cent. P. Taking phosphorus as the best guide, it is apparent how this all pig charge, although put on last, has become contaminated with the usual cylinder-metal charges run at the same time to the extent of about 50 per cent.

Experiment 2.—The first charge of all was cylinder scrap. It was followed by 8 cwts. of pig-iron of the following compositions:—TC, 3.33; Mn, 0.56; P, 0.09; Si, 2.00; and S, 0.05 per cent.

The charges did not come down as they were put on. Ten pieces were again selected of actual pigs going into the cupola, and a test-block taken from the middle 4 cwts. of this charge and partial analysis showed that the P. has risen to 0.38 per cent., showing how this charge has become contaminated with the ordinary iron of the day and details are again useless at a charges test. One might assume, after getting this information, that it is better to put on the pig-iron charge first and then melt it before it has a chance to become mixed with other metal. The analysis of the iron used in this experiment is so definitely low in phosphorus, that it is a first-class guide as to whether or not the charge desired has been attained; but being practically a hematite, and all pig at that, it is more difficult to melt than ordinary irons, and particularly so when put on as an early charge. One has therefore to face the contingency that, being all pig-iron, it would naturally come down very cold, so that there would be a possibility of tapping hole being stopped up.

The question arises then as to how are these losses to be overcome. The only way found by the author is to put on four to six charges towards the end of the blow and to take a test block out of third or fourth charge, which certainly approximated the desired composition.

Experiment No. 4.—For this a mixture consisting of 4 cwt. of pig-iron, 3 cwt. of scrap, and 1 cwt. of steel was used. This was calculated to give the following composition:—T.C., 2.78; Mn., 1.51; P., 0.56; Si., 2.26; and S., 0.065 per cent. The actual showed it to contain T.C., 3.03; Mn., 1.07; P., 0.61; Si., 2.02; and S., 0.110 per cent. The tensile of this iron 16.82 tons per sq. in. on a 0.798 dia. test piece, whilst 2,850 lbs. was registered as the transverse test.

In this experiment the phosphorus in the resultant iron is reasonably near the calculated percentage, near enough to assume the correct charge has been tapped out. Knowing these figures, any desired analysis can thus be obtained, within reason, by taking the above losses and gains into consideration.

Inspection and Final Testing.

This is an operation in cylinder founding that, until recent years, was badly neglected. The old way was to have the castings fettled, sandblasted, inspected in a cursory manner, and despatched. This department nowadays is very important, and one from which very valuable information can be obtained from day to day both by foundry and laboratory. Further, by rigid inspection and application of special tests, it enables one to retain in the works what at first examination appears a good cylinder, but on further inspection proves to be scrap. Every water-jacketted cylinder should be water-pressure tested from 50 to 100 lbs. pressure, as this finds out those serious porous parts that the motor cylinder is liable to contain,

and extra precautions can be taken in the core shop and foundry to obviate this trouble. Also, where large casts of any particular cylinder is being made, one is selected, of course, usually a waster, and broken up into small pieces. Information gained from this source is very valuable, as:

(1) The cause of the scrap can be located, and decided whether mould, core or material is at fault.

(2) It furnishes a guide as to whether the castings are coming out regularly to dimensions, especially in barrel thickness.

(3) Provides information as to strength of the metal as to brittleness and toughness.

(4) Exposes various fractures for visual examination as to grain size, hardness or softness, chilling, porosity and sulphur shots.

(5) Enables the chemist to take for analysis what is obviously the most important part of the cylinder, the barrel section, for complete analysis and hardness test.

Importance of Chemical Analysis.

Practically every large cylinder cast in the foundry is date-stamped with the day of the cast, the date being printed on the mould. Along with the daily silicon figure, the complete analysis is entered on a chart in graph form, which chart also contains details of the mixture, limestone used, coke used, and occasional tensile and Brinell tests. This yields valuable information, as it provides an indication as to whether any particular element is moving outside the desired limits, and when the machine-shop report is satisfactory on a run of about 500 castings, this chart can be referred to, and the details which helped lead to the good results utilised. Obviously the reverse applies with equal force.

Mixtures for Cylinders.

This must be so proportioned as to give a resultant iron of close-grain structure and to be free from porosity in order to withstand the water-pressure test. It must give a hard iron to withstand wear and friction, but not too hard to prevent ease of machining. Specially the castings must be free from chill, and in the case of many types of air-cooled cylinders the iron must be

Table II.—*Suitable composition for cylinder irons.*

—	Cylinders in general.	Water-cooled cylinders.	Air-cooled cylinders.
Total carbon ..	3.10 to 3.40	3.10	3.10
Comb. carbon..	0.40 to 0.70	0.65	0.60
Silicon	1.50 to 2.2	1.60	1.90
Manganese ..	0.60 to 1.2	1.00	0.80
Sulphur ..	0.08 to 0.12	0.09	0.10
Phosphorus ..	0.40 to 1.0	0.80	1.00

sufficiently fluid to run the fins to a good finish. To get an iron to meet all these requirements and avoid the chill is distinctly difficult. Very good results have been obtained where cylinder iron falls within the limits set out in Table II.

Mechanical Testing.

Allied to analysis is mechanical testing, which usually includes transverse test, deflection or bending, tensile strength, and hardness. It often happens that a mixture that produces good cylinders does not give the best mechanical properties, but one cannot sacrifice good castings for the sake of getting the best iron mechanically. But, at the same time, a good standard should be aimed at, and a recent test gave:—Tensile, 14.95 tons per sq. in. (.798 dia.); transverse, 2,860 on 1 in. sq. bar on 12 in. supports; deflection, 4 mm. or 0.16 in.; and hardness, 217 Brinell. The analysis to which these relate was T.C., 3.07; C.C., 0.50; Si., 1.54; Mn., 0.82; S., 0.109; and P., 0.72 per cent.

The above test is fairly typical of the regular run, and such tests as the above are carried out occasionally to ascertain that the cylinder mixtures are keeping up to standard mechanical properties. Referring to the physical tests, a very important one in reference to cylinders is the hardness test. The importance of testing for hardness at the part where the wear is likely to take place—that is, in the barrel portion—is illustrated from Table III:—

Table III.—*Illustrating the necessity for controlling hardness.*

	Bolting down boss.	Barrel section.	Diff. in Hard. Nos.
Mixture No. 1	187	166	21
„ „ 2	192	156	36
„ „ 3	217	174	43

These figures relate to a twin type of cylinder where the barrels connect without any intervening water space, and this interesting information was obtained when testing for a mixture to give a denser and harder metal in such cylinders, when the usual run of cylinder metal did not give sufficient hardness in the resultant casting.

Scrap due to Faulty Cylinder Iron.

Scrap castings can be due to unsuitable and faulty material; for example, a weak metal can cause the cylinder crown to burst under running test, and in the author's opinion the combination of high phosphorus, sulphur, and total carbon make this a poor iron for this class of cylinder. Another casting was scrapped during examination for blowholes and shots in top flange of cylinder, due to sulphur. In other castings, inability to machine and porosity in the barrel were likewise ascribed to high sulphur.

Piston castings are very liable to porosity in the bosses, and it is very noticeable that when the iron shows very high sulphur, above 0.12 per cent., this porosity may be so extended that the pistons must be scrapped after machining. Porosity in such cases is further extended by gases from finger cores.

An interesting example of a steel addition to pig-iron is one showing how the addition of 30 per cent. steel to a very soft open-grain pig so closed the grain as to bring it within the possibility of being used as a cylinder mixture. The mixture is made from 5 cwt. of pig-iron and 2¼ cwt. of steel. The analysis of the pig-iron is:—T.C., 3.30; Si., 3.74; Mn., 1.10; S., 0.05; P., 0.94. The calculated analysis gave T.C., 2.40; Si., 2.53; and P., 0.87 per cent. The actual analysis, however, was T.C., 2.80; Si., 1.90; and P., 0.71 per cent.

In conclusion, it is interesting to note that there is now a pig-iron on the market which is said to give added quality to existing cylinder irons. Although having a small quantity of this iron, the author has not yet had opportunity of trying it out, but the inclusion of vanadium, nickel and chromium in addition to the usual elements is worthy of comment. Its full analysis is:—T.C., 4.24; Si., 2.0; Mn., 0.70; S., 0.04; P., 0.08; Cr., 2.0; Ni., 1.0; Ti, 0.4. With CC., not given, it contains nine elements besides the iron (89.54 per cent.).

[A discrepancy has apparently crept in, as the text mentions vanadium and the analysis titanium. —Ed.]

Ferro-Manganese.

Of interest to British manufacturers of ferro-manganese is the appointment of a receiver for the American Manganese Manufacturing Company, one of the largest producers of the alloy in the United States. It is said to have a capacity of 150,000 tons per annum. The Company have been idle since last April.

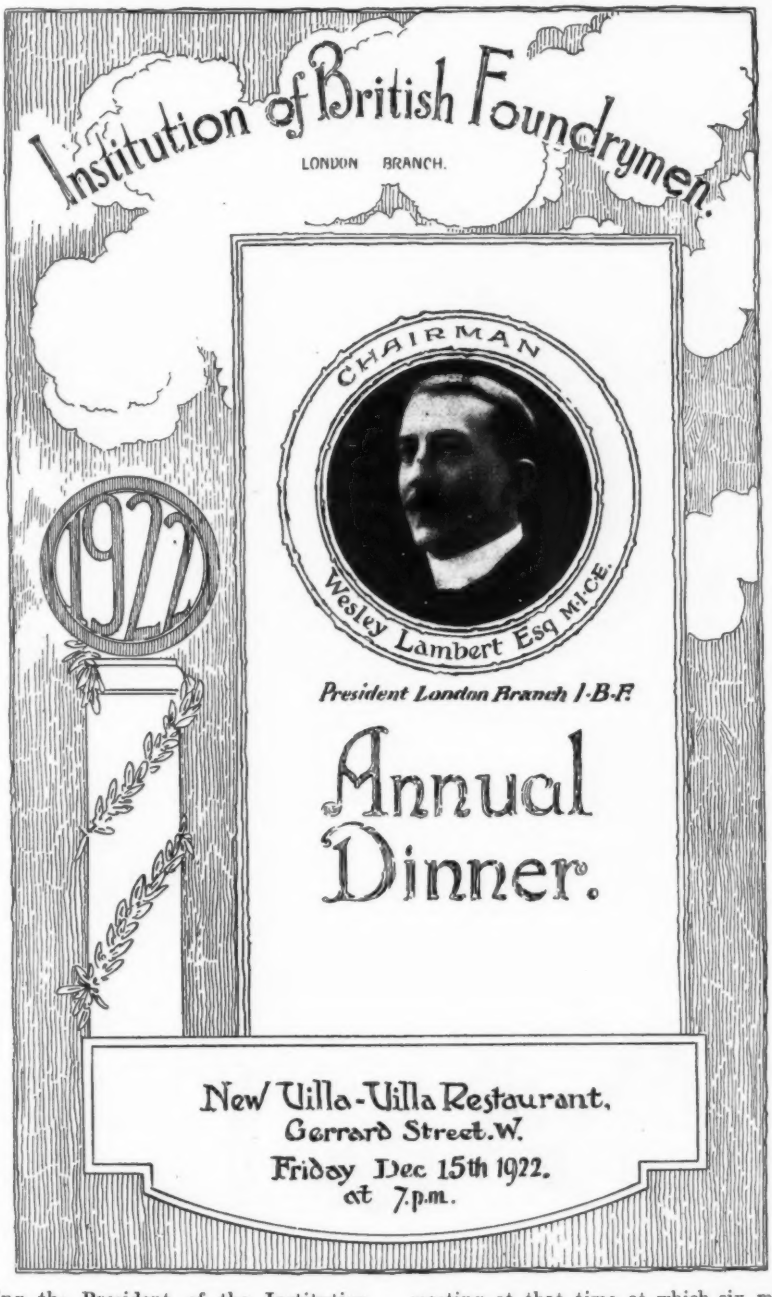
Design of Ammoniacal Liquor Stills.—Before the annual meeting of the Society of Chemical Industry at Glasgow, Mr. P. Parrish, A.I.C., in summarising his views as to the direction in which progress in the design of ammoniacal liquor stills is likely to proceed in the future, remarked that designers must concentrate their attention and energies to the evolution of the elements of a still which will be economical as regards steam consumption. Data must be arrived at as to the relative value of attenuated bubbling, as compared with time contact of the liquid and the vapours as a factor in aiding equilibrium. As regards the utilisation of the surplus heat leaving the saturator, it is evident that the present arrangement of plant as generally known must be improved in order that more satisfactory conservation of the heat available can be ensured.

Institution of British Foundrymen.

ANNUAL DINNER.

The annual dinner of the Institution of British Foundrymen took place at the New Villa-Villa Restaurant, London, on Friday, December 15, Mr. Wesley Lambert, M.I.C.E., President of the London Branch, occupying the chair.

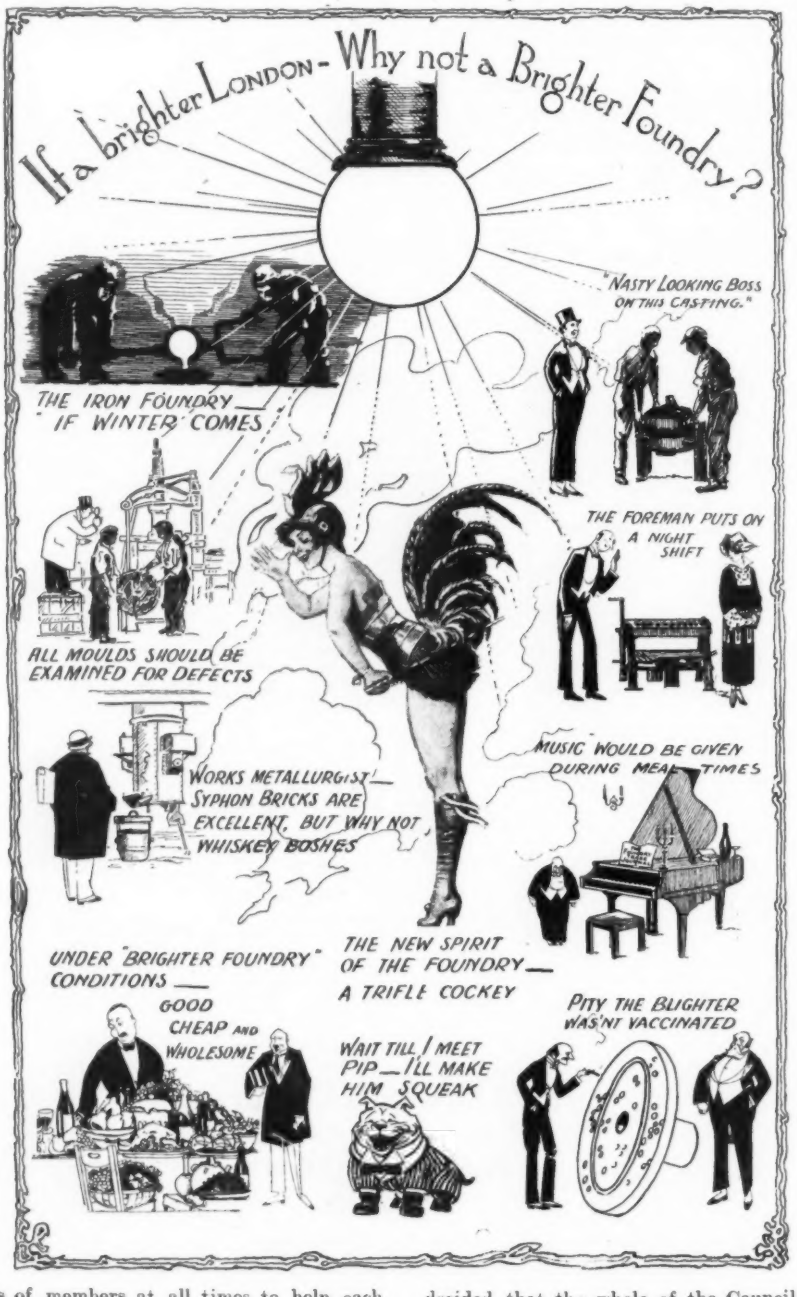
There was a large assembly of members and visitors from all parts of the country. Amongst those present being the President of the Institution (Mr. H. L. Reason), the President-Elect and Past-President (Mr. Oliver Stubbs), Dr. Percy Longmuir, and Mr. J. Ellis (Past-President), Mr. Roxborough, of the British Thomson-Houston Company, Mr. Adamson, Secretary of the Institution of Marine Engineers, Col. W. F. Cheesewright, D.S.O., Dr. D. Hanson, Mr. G. W. Hobbs, and Mr. W. G. Hollinworth (General Secretary of the Institution).



MR. G. W. HOBBS, who proposed the toast of "The Institution of British Foundrymen," in the absence of Mr. H. B. Weeks (Chairman B.C.I.R.A.), said he thought that no one would doubt his sincerity when he said he was confident that the present and past prosperity of the British Empire was due in a very large measure to the work of such institutions as the Institution of British Foundrymen. He was sure the members must feel great pleasure in the fact that the Institution, which was formed in 1904, and held a meeting at that time at which six members were present, could now claim a membership of 1,700. Some of the gentlemen who started the Institution in 1904 were present this evening, Mr. Ellis and Dr. Longmuir being two of them, and he (Mr. Hobbs) felt particular gratification at being able to meet so many people at the gathering. He concluded by wishing prosperity to the Institution.

MR. H. L. REASON, responding to the toast, said he felt it a great pleasure to be asked to respond to the toast of "The Institution of British Foundrymen." He thought it was within his prerogative to extend to the President and Members of the London Branch the Institution's

best wishes. The London Branch had had a long and interesting career. No one thought of the London Branch without associating with it Mr. Ellis and Mr. Bartlett. But for the enthusiasm of these gentlemen and a few others they might not now be spending this pleasant evening. He might also say that as an Institution the other members envied the London Branch its Secretary (Mr. Faulkner). To have a secretary with the qualification of being Editor of the FOUNDRY TRADE JOURNAL, put the London Branch in a unique position. After complimenting the artist on the design of the menu, he said he felt that that was a great feature of their Institution, the largely due to their immediate Past-President (Mr. O. Stubbs). He was in the unique position of being President of the National Iron Founders' Association, and he came into close contact with the employers, and lost no opportunity of putting the work of the Institution before them. It would be remembered that they made the splendid gift of the "Oliver Stubbs Medal," to be competed for annually. Another gratification they received from subscribing firms joining the Institution was that they began to sympathise with the work it was doing. A Congress and Exhibition were to be held in France next year, and at the last meeting of the Council of the Institution it was unanimously


If a brighter London - Why not a Brighter Foundry?
"NASTY LOOKING BOSS ON THIS CASTING."
THE IRON FOUNDRY — IF WINTER COMES
THE FOREMAN PUTS ON A NIGHT SHIFT
ALL MOULDS SHOULD BE EXAMINED FOR DEFECTS
WORKS METALLURGIST — SYPHON BRICKS ARE EXCELLENT, BUT WHY NOT WHISKEY BOSHES
MUSIC WOULD BE GIVEN DURING MEAL TIMES
UNDER "BRIGHTER FOUNDRY" CONDITIONS —
GOOD CHEAP AND WHOLESOME
THE NEW SPIRIT OF THE FOUNDRY — A TRIFLE COCKEY
WAIT TILL I MEET PIP — I'LL MAKE HIM SQUEAK
PITY THE BLIGHTER WAS'NT VACCINATED

willingness of members at all times to help each other in case of difficulty, and it did not matter in what part of the British Isles they lived, or for what Branch of the Institution they worked, the object of every member was to widen its influence. The past Councils had always worked with that object in view. If they had not done so there would not have been 1,700 members to-day. Since January last they had 19 new subscribing firms, 107 members, 115 associate members, and 29 associates, a total of 270 elected since January last. That went to show they were a very live Institution. It was a gratifying fact that the list of subscribing firms was growing. This was decided that the whole of the Council be elected official representatives of the Institution at the Congress. There had been a little misunderstanding as to the extent to which the Institution would co-operate. He believed the Americans were sending over 50 foundrymen to represent their Association at the function, and they were most anxious to have the Institution of British Foundrymen with them. The Council looked forward to having 150 or more to represent the Institution. By that time the chain of office would have been passed back to Mr. Stubbs.

THE CHAIRMAN, inviting Mr. Oliver Stubbs to propose the toast of the "London Branch," said

he had no hesitation in saying there had never been a more popular President than Mr. Stubbs. They had heard what Mr. Reason had said about Mr. Stubbs' work towards securing the well-being of the Institution, and they all knew that what Mr. Reason said was true. Mr. Stubbs had done this good work in a most unostentatious manner. When he (Mr. Lambert) was in America a few days ago he met with evidence of the great reception Mr. Stubbs had received there.

MR. OLIVER STUBBS, proposing the toast said he (Mr. Stubbs) would probably get into trouble for saying that he thought his toast, "The London Branch and its President," was the most important. If there was a Branch they had to be proud of it was the London one. Two or three years ago they were getting into low water, and then they pulled themselves together, largely, he thought, owing to the efforts of Mr. Faulkner. He did not think too much credit could be given to the work Mr. Faulkner had done, on top of the work he was doing during the day. The members were very pleased to see Col. Cheesewright there, and to find that the rumour that he was not at all well had been untrue. Also, it was entirely to the credit of the London members that they had travelled such great distances to attend the meetings in London. He did not think there was a Branch which was so spread about, and he knew it cost some men from 5s. to 7s. to attend a meeting. At last year's dinner they were looking forward to this year as the great year of hope. Unfortunately it had not been, but although he was an optimist, he felt that there was every sign now of revival in trade, and he hoped there was no symptom of any further reduction in wages. Some people were not ordering all they could order, because they were waiting for wages to come down. He said: "Don't bring wages down, but do a little more work." If they did that they were more likely to get their wages increased. Wages were sufficiently low in all conscience. He was sure that the London Branch would be very prosperous in view of those who were at the head of it. There was no man more qualified than Mr. Lambert to act as President. His expert opinion was valued very much, and he (Mr. Stubbs) hoped he would long be spared health and strength to continue his energies in the cause of the Institution, and he hoped the time was not far distant when Mr. Lambert would become President of the Institution.

THE CHAIRMAN, in responding to the toast, gave an account of the work of the London Branch during the past years, including the reading of the important Papers and the holding of the valuable discussions, and he also expressed the thanks of the Institution to the proprietors of the important works to which visits had been made during the year, and to the gentlemen who had given their valuable time conducting the members round those works. He thanked Mr. Stubbs for his kind words in proposing the toast, and the company present for the enthusiastic manner in which they had received it.

COL. CHEESEWRIGHT, Vice-President of the London Branch, also responded with a typical after-dinner speech, in which the proposer and responder came in for a good deal of humorous "leg-pulling."

MR. V. C. FAULKNER, Secretary of the London Branch, gave the toast of "The British Cast-Iron Research Association," coupled with the name of Dr. Percy Longmuir. He said that apart from being Cast-Iron Research Association, it was their baby, as its two vice-chairmen were two of our Past-Presidents (Mr. Stubbs and Mr. Cook), and on its Research Committee there were ten members of the Institution and five other people. One could see immediately the close association between the two societies. A very important aspect of the British Cast-Iron Research Association was the technical bureau. It was better to be *au fait* with good past knowledge than to be dabbling in indifferent or unproved present knowledge. Dr. Percy Longmuir was in every way qualified to be Director of the Research Association, but in one respect he was sorry he had been appointed. Hitherto, foundrymen could go to him for help in their difficulties, but now it would be a breach of confidence, unless they became members of the B.C.I.R.A.

DR. PERCY LONGMUIR, in response, said he wished to acknowledge his indebtedness to the officials of the British Cast-Iron Research Association. No man could have had a greater welcome nor greater help than he had had. On appointment he was given a great docket of papers from which he knew everything that had been done. He thanked the late acting-director, Mr. Fletcher, for his great help, and also the various committees. The founders in Great Britain and Ireland had also generously offered help. He felt that the coming months would show possibilities of good work by co-operation—not by the work of the individual. Machinery had already been put into force, and would be operating early in the New Year to carry out investigations to provide material, they hoped, for a series of physical constants that would prove of value to every foundry in the land. With regard to research, unless this country woke up, and the various industries supported the scientific side of their industry, they would suffer. Over 20 years ago the Krupp works in Essen had, in addition to their routine chemists, a research staff of over 60. That meant progress. The only mistake Germany made was in going to war. But this support did not mean the solving of all the problems that were current in every foundry. Co-operation was the only solution. The Research Association specialised on the grey and white cast iron, semi-steel and malleable iron, and no man could solve all those problems. He could guarantee that when reports were issued to members, scientific terms would be reduced to practical terms, and all reports would be from the foundry floor, supplemented by the best scientific aid that could be given. They had, during the last week, carried through a scheme that would give them access to the best scientific authorities in this country and also the best practice.

THE CHAIRMAN, proposing the health of "The Visitors," mentioned, amongst others, Mr. Adamson, Secretary of the Institute of Marine Engineers, to whom he said they owed a great debt of gratitude for enabling them to secure such a splendid home for the London Branch. He also referred to the great service Mr. Hollinsworth, the General Secretary, had rendered to the Institution. He concluded by thanking the artistes who had contributed to the entertainment that evening, and the designer of the menu, Mr. Weatherstone. They were much indebted to him, through the good offices of Col. Cheesewright.

DR. D. HANSON, replying on behalf of the Visitors, said the invitation to the gathering was accepted as being in the spirit of the co-operation that ought to exist between different scientific and technical societies. He came there as the Chairman of the local Branch of the Institute of Metals. One thing that pleased him very much was that as soon as it was known such a society had been formed they received a cordial invitation to hold a joint meeting with the Institution of British Foundrymen. His society also owed much to Mr. Adamson, who had also found them an extremely nice home.

THE CHAIRMAN, in conclusion, thanked Col. Cheesewright and Mr. Faulkner for all they had done to make the entertainment a success.

NOTES FROM THE BRANCHES.

Lancashire Branch.

Mr. Stubbs, past-President of the Institution, recently gave an informal chat to the Branch on the subject of his American experiences. A lecture on similar lines was given before the West Riding of Yorkshire Branch, and has already appeared in our columns.

Forges et Laminoirs de l'Alliance.—This Belgian concern is increasing its capital by the issue of 20,000 new shares without indicated value at 450 fcs. each. The nominal value of the present capital is only 3,000,000 fcs., and is divided into 30,000 shares. The new shares are to rank equally with the old shares.

Comparison of Birmingham Brass Factories.

Variety of Casting Methods.

In a Paper presented before the Birmingham Local Section of the Institute of Metals by Mr. R. J. Redding, Wh.Sc., A.M.I.C.E., on December 5, entitled "Some Notes on Casting 70:30 Brass," the author gave details of some visits he made to Birmingham factories in connection with the establishment of a large concern at Southampton to provide cartridge brass during the war.

The author stated that in visiting a large number of Birmingham foundries producing brass strip of the same dimensions a point to be noticed was the great diversity of methods and equipment. In Birmingham brass had been made for generations, yet when visiting a large number of their works cases were found in which everything that could be done wrongly was being done, whereas neighbouring works were totally different. Apparently, there were no accepted or well-defined lines, and manufacturers advanced their experience of many years as an argument for the continuance of wrong methods. There had to be considerable improvement before brass could be obtained suitable for cartridge making, and, undoubtedly, the war considerably raised the standards of manufacture. It was obviously desirable to seek improvement in the direction of attaining a common general standard method. The great diversity in the size of moulds was especially noticeable, though this was partly accounted for by the rolling mill equipment available for subsequent treatment. But, as a rule, every firm was entirely satisfied, not only that the method employed was the best, but the only one possible for the production of good 70:30 brass. Further inquiry elicited the conclusion that a good surface was the only item considered, solidity of the interior either being ignored or treated as secondary.

Composition of Moulds.

In regard to moulds, too much attention could not be given to ensure good moulds of the best materials. As a rule they were made of grey cast iron, fairly open in texture. A hard iron with a fine smooth surface would seem more suitable, but in practice the life of such moulds is usually very short owing to cracking. One mould which gave a fairly long life had the following analysis:—Graphitic carbon, 3.57; combined carbon, 0.10; silicon, 2.10; manganese, 0.51; sulphur, 0.06; and phosphorus, 0.23 per cent., and it was cast from a cupola-mixture consisting of 4 cwt. of No. 1 hematite iron, 5 cwts. 3 qrs. 8 lbs. of machinery scrap, and 40 lbs. of 12 per cent. ferro-silicon. To ensure the essential good surface many firms planed the moulds before use, but there were very divided and emphatic opinions on that, and, personally, he would prefer to leave on the cast-skin. If this was clean and free from casting defects it would generally wear better than a planed surface. By casting the mould face downwards with sufficient inclination to carry up any slag or extraneous matter, and other conditions being satisfactory, a good mould should be obtainable. It was common, though not universal, to anneal moulds before use, and on this practice varied a good deal. In all cases, it was a safe practice, involving little trouble where annealing furnaces were available.

Design of Mould.

In designing the mould the metal should be equalised so that the cast ingot should have equal cooling both back and front, and the shape should be so arranged as to secure equal resistance of both sides to distortion. The sudden heating on one face only produced distortion and led to surface cracking.

Recalling his experience at Government factories, the author said that at Woolwich and Southampton screw rings for mould-clamping were used, but did not seem to be favoured in Birmingham, where wedges were employed, often driven home with great force. The ideal mould would be one without a joint at all, or with no joint at the side, and only a bottom joint as used for steelworks practice for medium and large slab ingots. Unfortunately, this was out of the question at present, in view of the size of ingots called for to meet the rolling mill conditions. They would either be too narrow or too long to admit of cleaning and dressing the moulds. With a mill of the necessary size and power it should be possible to increase largely the sizes of ingots, especially those intended for the rolling of sheets. This would give the advantage of improved surface with an important saving in labour. The nearest approach to the jointless-mould in present practice was the box pattern, with a joint at two corners of the ingot, instead of at the middle of the ingot sides. It was quite an advantage to have a free vent to the outside for any gases evolved from dressing-oil. To localise any tendency to piping and to avoid contraction-cavities across the width of the ingot, the moulds were sometimes given a slight camber, though the practice was not so general as in nickel silver ingots.

Dozzles.

With regard to hot tops, in use for many years in steelmaking and sometimes advocated for brass casting as a remedy for piping and hollow ingots, it must be remembered that the hot top could only influence the solidity of the ingot, and was not a remedy for blow-holes or surface defects. Enlarged tops, arranged by tapering out one-half of the mould, were found to be of great advantage when using tilting furnaces and pouring on to the back of the mould. With regard to the splitting of the molten stream in pouring into the mould, if the two streams became unequal, there was a danger of dirt, dross or pieces of charcoal being carried to one side, gas bubbles locating there. Obviously, the preliminary skimming in such cases must be very thorough.

Tall Moulds.

While abnormally tall moulds for brass casting have frequently been condemned, they found in steel practice, on the contrary, the adoption of schemes for putting ingot moulds on top of one another up to three high. Obvious drawbacks were the excessive fall of metal involving splashing and the liability to bind or hang in the mould. The fluid pressure resulting from the extra height would tend to increase solidity. The extensive use of this method in connection with wire drawing seemed to show that the defects encountered were not so serious as some people complained.

Mould Dressings.

Particulars were given of numerous materials used for mould dressing, and there was a wide field for research, particularly as to the properties of a porous or granular surface like open grain iron for moulds, and its effect on the surface of the alloys cast against it. The increase in melting and casting temperatures in some cases made the use of oil either difficult or impossible, and this explained why it was more difficult to obtain good surfaces on cupro-nickel than on brass, and still more so on nickel and low carbon steel. A much more careful storage and care of surfaces of ingot moulds would be to the advantage of castings produced after a rest interval. He had found great advantage in keeping moulds in the corner of a core oven.

In no case did he observe that mineral oils were used, which he considered strange in view of the wide range of properties such oils possessed.

At Southampton, where they used very large quantities of oil, they changed successively from lard oil to seal and whale oil, through the exhaustion of supplies, without observing any difference in the quality of the surfaces. Some of the finest surfaces were obtained with a dressing of melted resin, although some of the ingots were liable to black blow-holes. With excessive oil or resin dressing, a large flame and dense volumes of black, sooty smoke accompanied the pouring, adding to the men's discomforts. Yet many casters considered those volcanic effects quite necessary.

Water cooling was not considered desirable either from the point of view of the ingot surface or the mould surface, and should be avoided if possible.

Casting Temperatures.

With regard to the temperature of pouring, the author quotes with approval recommendations by experts of a range of casting temperatures for pure 70:30 brass between 1,150 and 1,220 deg. C. That recommendation was based on many years' experience at Woolwich, and they followed those temperatures as far as possible at Southampton. On his visit to Birmingham he found a very wide range of temperatures, obviously both too high and too low. There was, he thought, a great tendency to cast at low temperatures through consideration of surface, the keeping down of fuel costs, and securing "quicker" melting. The speaker strongly advocated the evolution of useful workshop tests where no scientific staff was available.

Pouring Angles and Ladle Pouring.

The angle at which the metal was poured into the moulds was worthy of consideration. Practice varied very greatly, but the ideal angle would be that which allowed the stream to fall well towards the bottom before striking. In other words, the mould should coincide as nearly as possible with the stream-line of the metal being poured. Insufficient attention had been given to the temperature of moulds, although it was fully recognised that very hot or very cold moulds gave bad surfaces. They should try to find out what was the ideal temperature for each alloy. At Southampton they had found it a good practice to leave the last batch of ingots in the moulds for the next shift, which proved sufficient to keep them warm during the interval. There was no doubt that the practice of ladle pouring with a bottom nozzle closed with a fireclay stopper, which was quite the usual practice of steelworks, would be useful in evolving non-metallic inclusions. In using a ladle a funnel would probably be necessary to guide the metal into the narrow opening of the strip mould. The common practice of bottom pouring in steel works had been advocated as applicable to non-ferrous ingots, but he (Mr. Redding) did not favour the system.

In conclusion, the author pointed out the necessity for research work on such matters as (1) properties of cast iron as a mould material with a view to improvement or the discovery of a substitute; (2) the ideal material for mould dressing; (3) robust methods for temperature measuring; (4) the part played by atmospheric moisture and surface oxidation of moulds in surface defects; (5) advantages or otherwise of fluxes; (6) the relations of height, width and depth of moulds to solidity and surface; (7) possible increases in the size of brass trade equipments on the lines of ferrous industry.

Gravimetric Method of the Determination of Phosphorus in Pig-Iron.*

Weighing as Ammonium Phosphomolybdate.

For this determination from 1 to 5 grammes of the sample are employed according to the phosphorus content. The weights recommended as most convenient are as follows: 5 grammes in all cases where the probable phosphorus content is less than 0.10 per cent., 2.5 grammes where it is between 0.10 and 0.20 per cent., and 1 gramme where it is above 0.20 per cent.

The proper amount of the sample is weighed and transferred to a glazed porcelain dish, which is provided with a cover glass, and 25 to 60 c.c. of HNO_3 (sp. gr. 1.13) are cautiously added. Gentle heat is applied until the sample is decomposed, when the solution is evaporated rapidly to dryness. The cover glass is removed and the dish and contents are heated with the full flame of an Argand or Bunsen burner until the acid is completely expelled. After cooling, 30 to 40 c.c. of concentrated HCl are added and gentle heat is applied until the soluble portion is dissolved. The dish is placed upon a suitable asbestos ring in order to prevent the formation of a crust of separated salts on the sides of the dish, and the solution is evaporated to the first appearance of a film upon its surface. The dish is then removed from the heat, 10 c.c. of concentrated HNO_3 are added, and heat is again applied for one minute. Approximately 40 c.c. of cold water are added, when the solution is stirred and filtered through an 11 cm. filter paper into a 500 c.c. flask. The filter is washed with cold HNO_3 (1:50) until free from iron solution, which insures also the complete removal of the soluble phosphate.

In the case of very exact work, the residue of silica and graphitic carbon is examined for the presence of phosphorus as follows: The residue and filter paper are ignited in a platinum crucible and the silica is volatilised with hydrofluoric acid in the presence of 2 or 3 drops of sulphuric acid. The resultant residue is mixed with a small amount of sodium carbonate, and the mixture is fused. The melt is disintegrated in hot water, the insoluble material is separated on a filter paper, and the filtrate, which contains the phosphate, is added to the main solution.

To the filtrate or filtrates are added 25 c.c. of concentrated AmOH. The flask is shaken until the precipitate coagulates, when 25 c.c. of concentrated HNO_3, which should be sufficient to dissolve the precipitate and allow an excess of 7 to 10 c.c., are added. The comparatively large amounts of ammonia and nitric acid are prescribed in the case of 5-gramme samples and are essential in that they insure a sufficient proportion of ammonium nitrate in the solution. When smaller quantities of the sample are used, the amount of ammonia may be decreased, but there should always be an excess of nitric acid as indicated.

The solution is heated to 80 deg. C., 50 to 75 c.c. of the molybdate solution are added, and the flask is shaken for five minutes. The yellow precipitate is allowed to settle, when it is collected upon a 9 cm. filter paper which has been previously dried for one hour at a temperature of 115 deg. C. and weighed between ground-edge watch glasses. The precipitate and paper are washed with HNO_3 (1:50), dried in the same manner as the paper and weighed.

The increase in weight, multiplied by 1.65 and divided by the initial weight of the sample taken, is equivalent to per cent. phosphorus.

Weighing as Magnesium Pyrophosphate.

The yellow precipitate of ammonium phosphomolybdate as obtained above, while still moist, is dissolved from the filter in a hot ammonium citrate solution, the filter is thoroughly washed with hot water, and the solution is retained in a 100-c.c. beaker. Five to 10 c.c. of magnesia mixture are added to the cold solution, which is then stirred for five minutes. After standing for three hours, the precipitate of magnesium ammonium phosphate is collected upon a 9-cm. filter and washed with AmOH (1:4) until free from soluble salts. The precipitate and paper are transferred to a porcelain crucible and ignited at a low temperature for 15 minutes and finally at a high temperature for 10 minutes. The weight of magnesium pyrophosphate is multiplied by 27.87 and divided by the weight of the sample taken to find the percentage of phosphorus.

Solutions required.

Ammonium Citrate Solution.

Citric acid	50 grammes
Concentrated ammonia ...	350 c.c.
Water	650 c.c.

Magnesia Mixture.

Magnesium sulphate ...	84 grammes
Ammonium chloride ...	250 grammes
Water	665 c.c.
Concentrated ammonia ...	335 c.c.

*A method used and published by the United States Steel Corporation.

Engineering at the British Empire Exhibition.

Mr. F. C. Fairholme and Mr. W. B. Richardson, both members of the Institution of British Foundrymen, have been asked to serve on the special committee for the Engineering Section of the British Empire Exhibition. All engineering and electrical trade exhibits are being organised by the British Engineers' Association and the British Electrical and Allied Manufacturers' Association.

Costs in Iron and Steel Production.

In his Presidential address before the West of Scotland Iron and Steel Institute at the first meeting of the new session (a report of which appears in the "Journal" of the Institute, Vol. XXX., Part 1, just issued), MR. E. H. LEWIS, M.A., dealt with the question of costs in iron and steel production, and with the methods by which they had been, and might be still further, reduced. Remarking that the best technical methods of manufacture were useless unless they lead to a cost of production which was less than the price the consumer was prepared to pay, he went on to say that costs could be roughly divided into the following classes:—(1) Raw materials, such as ores, scrap, pig-iron, fuel, etc.; (2) other materials, such as bricks, spare parts, stores, etc.; (3) transport; (4) standing charges, including taxation, both Imperial and local; (5) wages. The costs of raw materials were not under the control of the works technical staff, but the figures in Table I., showing how some of the principal raw materials had come down in price, might be of interest:—

TABLE I.—*Comparison of Cost of Raw Materials.*

	July, 1914.	"Peak."	October, 1922.
Ore	100	355	119
Limestone	100	277	200
Coal	100	323	200
Coke	100	359	154
Hematite pig-iron ..	100	460	161
Scrap	100	500	143
Ferro-manganese ..	100	462	182
Silica bricks	100	289	160

Transport rates have been reduced in recent months, but only to a small extent, and they are still far too high to permit of a general resumption of trade. At the highest point the extra cost of transport, compared with 1914, showed an increase of between 20s. and 30s. per ton of plates.

Standing charges generally do not come within our consideration, but, owing to recent decisions with regard to local taxation, it has become more and more necessary for the technical staff to take cognisance of this question. Without going into details, an example may be given which seems to show that, in the words of Mr. Bumble, "the law is a ass." It has been decided that, where electric power is purchased, a rotary converter is wholly a heritable subject, whereas in the case of a motor-generator the motor is heritable and the dynamo is not. From prices recently received it appears that for a supply of 250 kw. of direct current a rotary converter would cost approximately £200 less than a motor-generator. But with owner's and occupier's rates together at 15s. in the pound the capital sum representing the annual rates to be paid is £510 more in the case of the rotary converter. Of course, this is only one point which must be taken into consideration in deciding on one form of conversion or the other.

There are two points with regard to wages about which much confusion exists in the public mind—the question of nominal wages as against real wages, and the question of wages rates as against wages costs. In order to try and shed some light in an elementary way on these questions some figures have been prepared. Table II. shows the varying wages costs of a ton of acid-steel plates, made from hematite pig-iron produced in coal-fired blast furnaces, in the years 1912-1920, together with an estimate of the cost in September last:—

TABLE II.—*Comparison of Wages Paid to Colliers, Blast furnacemen, and Steelworkers per ton of Steel Plates.*

	Colliers.	Blast-furnacemen.	Steel-workers.	Total.
1912 ..	37.5	10.5	52.0	100.0
1913 ..	46.7	10.9	64.9	122.5
1914 ..	52.5	11.7	61.4	125.6
1915 ..	58.4	12.6	67.7	138.7
1916 ..	81.3	16.3	88.6	186.2
1917 ..	102.6	19.5	99.4	221.5
1918 ..	147.7	24.9	130.0	302.6
1919 ..	250.2	40.3	186.8	477.3
1920 ..	296.4	52.6	218.0	567.0
Sept., 1922*	73.0	23.5	113.3	209.8

*Estimated.

As a contrast to the comparison of the nominal wages costs (in money value) given above, another comparative set of figures has been prepared (see Table III.), showing the equivalent "real" wages costs (in commodity value). This is obtained by altering the money value into purchasing value in accordance with the average of the Board of Trade "cost of living" figures for each year.

TABLE III.—*Comparison of Purchasing Power of Wages Received by Colliers, Blast-furnacemen, and Steelworkers per ton of Steel Plates.*

	Colliers.	Blast-furnacemen.	Steel-workers.	Total.
1912 ..	37.5	10.5	52.0	100.0
1913 ..	46.7	10.9	64.9	122.5
1914 ..	51.4	11.5	60.1	123.0
1915 ..	47.4	10.2	54.9	112.5
1916 ..	55.6	11.1	60.6	127.3
1917 ..	58.2	11.0	56.3	125.5
1918 ..	72.6	12.2	64.0	148.8
1919 ..	116.3	18.7	80.8	221.8
1920 ..	119.2	21.1	87.7	228.0
Sept., 1922* ..	40.8	13.1	63.3	117.2

*Estimated.

These figures are prepared from actual yearly results, and, of course, they include the effects of many different causes. During some of the years costs were increased by strikes, such as the railway strike, the bricklayers' strike (in steelworks), the first miners' strike, and so on. But the costs of strikes are rightly included, as they must ultimately be borne by the industry.

During the war, and after it, wages costs were very seriously increased by the dirty and unsuitable fuel which had to be used, and the figures given in Table IV. make this obvious:—

TABLE IV.—*Comparison of Consumption of Raw Materials and Production at Blast Furnaces.*

	Ore used.	Coal used.	Limestone used.			Output per furnace
			To flux ores.	To flux fuel.	Total.	
1912 .	100.0	100.0	—	—	100.0	100.0
1913 .	98.3	103.8	—	—	112.7	103.1
1914 .	98.5	106.8	—	—	122.1	102.8
1915 .	99.6	109.9	33.3	89.0	122.3	95.5
1916 .	100.2	115.7	30.5	90.1	120.6	91.7
1917 .	97.9	113.6	49.7	93.4	143.1	88.2
1918 .	99.7	116.3	60.1	106.4	166.5	83.6
1919 .	101.1	125.3	50.9	137.6	188.5	80.7
1920 .	102.2	122.6	52.6	132.0	184.6	84.0

TABLE V.—*Comparison of Consumption of Fuel in Steel-Works per Ton of Plates.*

	Producers.	Boilers.	Cranes, etc.	Total.
1912 ..	66.0	30.3	3.7	100.0
1913 ..	78.9	24.3	4.4	107.6
1914 ..	80.7	24.0	3.6	108.3
1915 ..	79.8	21.4	4.4	105.6
1916 ..	88.0	24.2	5.3	171.5
1917 ..	93.7	24.9	4.8	123.4
1918 ..	101.8	34.0	5.2	141.0
1919 ..	108.9	36.1	5.7	150.7
1920 ..	106.4	35.1	3.6	145.1

Again, wages costs are influenced by sliding-scale movements. Such scales, though nominally representing prosperity in the industry or the reverse, were made to rise during the war by causes which did not really reflect such prosperity. The result was that many wage rates, in their proportion to pre-war rates, greatly exceeded the cost of living figures. Not only "nominal" but "real" wages were very much increased. But the iron and steel trades were wise not to allow any interference with sliding scales, and, on the contrary, to largely extend the number of men whose wages were regulated in that way. We sometimes boast that our trade can give an example to all other trades in our methods of regulating wages. Sliding scales do not form a perfect system of profit sharing, but they seem to be the only system which has successfully stood the test of time.

Output has necessarily an influence on wages costs, as the time-wages cost must vary inversely as the output. In steelworks the influence of output and sliding scales can easily be expressed in an equation. Thus in each department:—

$$\text{Wages cost per ton} = \text{Tonnage base wages cost per ton}\left(1+\frac{\text{melters scale percentage}}{100}\right) + \frac{\text{Stand'rd output}}{\text{Actual output}}\left\{\begin{array}{l} A\left(1+\frac{\text{melters scale percent'ge}}{100}\right) \\ +B+\lambda.\ \text{melters scale percentage} \\ +C+\mu.\ \text{engineering trade war bonus} \\ +D+\nu.\ \text{building trade "fodder" bonus}\end{array}\right\}$$

Where

A = base time wages cost per ton of standard output of straight scale men.

B = base time wages cost per ton of standard output of men on "stepping scheme."

C = base time wages cost per ton of standard output of tradesmen other than building trade.

D = base time wages cost per ton of standard output of building tradesmen,

and λ, μ, and ν are constants to be determined.

Yields have a big influence on wages costs. The question of yields is under the control of the technical staff. It is easy to draw up a formula which shows the effect of yields upon wages cost. By applying this formula in a particular case it has been found that the difference due to a fairly normal variation of yield was equivalent in wages cost alone to a difference of forty men in the staffing of the plant.

$$\text{Wages cost of plates} = \frac{100}{\text{yield of plate}} \times \left\{\frac{100 \times \text{Ingot wages cost}}{\text{yield of slab}} + \frac{\text{wages cost at cogging mill}}{\text{wages cost at plate mill}}\right\}$$

From these two equations, if the constants be once calculated for the standard output, it is possible in a very few minutes to forecast the wages cost in any possible circumstances of output, yield, and scale movements.

There is much confusion in the minds of the manual workers between the rate of wages paid and the wages cost. Naturally the workman is mainly interested in what he takes home on Friday night. But the consumer is not at all concerned with what is in the individual "poke," but with the cost per ton which the manufacturer has to bear and pass on to him. While wages rates in the trade have generally come down to a point below the official cost of living figures, a careful estimate of wages costs shows that they are still all above the Board of Trade percentages in their relation to pre-war costs. This, of course, is explained by the lower production per employee due to the shorter working day, which is brought out in Table VI.:—

TABLE VI.—*Output Per Employee per Annum in Tons.*

	Pig-iron.	By-products.	Steel.
1912	382.3	317.4	106.8
1913	350.3	346.2	79.4
1914	320.6	349.2	88.7
1915	385.8	315.9	102.3
1916	334.9	330.2	80.6
1917	330.9	330.1	88.3
1918	315.8	347.5	89.3
1919	245.5	288.3	50.8
1920	226.3	270.0	59.0
1921*	254.0	—	—

* Rate per annum for 3 months.

The shorter hours were introduced in the spring of 1919.

The aim of each employer should be to endeavour to keep individual wages up as far as is reasonable, and at the same time to reduce his wages cost. A certain amount can be done in this direction by improved technical methods and plant, which would cause an increased production per man, but at the moment there is no prospect of such radical changes of that kind as would compensate for the increased cost of the shorter working hours. For certain particularly hot and heavy jobs one is bound to have every sympathy with the present working hours, but it is not clear how it is possible that men can retain their pre-war standard of living with 37½ hours work per week on jobs which do not require any great physical or mental exertion. This point may be stressed by some simple figures. In July, 1914, the blast-furnace labourers' shift wage was equal to 14⅔ 2-lb. loaves per shift. To-day it is equal to 16 loaves per shift, and a much shorter shift. In 1914 it meant a loaf for every 49 minutes; to-day a loaf for every 30 minutes. Coming to wages cost, in 1914 the cost per ton of all labour at the blast furnaces was equal to 19½ loaves per ton; to-day it would be 27 loaves per ton. Where are the 7½ loaves to come from? The consumer won't provide them, because he has got the same idea about working shorter hours for the same wages for himself, and he only wants to provide 13 loaves instead of the 19½ which he provided before the war. Not until this conundrum is solved can we see any real hope of a revival of industry.

Some slight reduction in cost might be brought about by a wider application of payment by results. It is generally considered that in the iron and steel trade payment by results is of general application, and it is rather surprising to find that in reality a comparatively small amount of total wages paid consists of tonnage payments.

One further source of relief is by using to the best advantage every possible by-product; in fact, no industry to-day can live without taking full advantage of such sources of revenue. There was a danger within the past few weeks of one such small source being cut off from iron and steel works, owing to the demand made for assessment of slag-heaps as heritable. However, the Valuation Committee evidently saw that they would hurt themselves as much as anyone else if they agreed with the assessor's point of view. The various local authorities are some of the principal users of material of this kind, and no doubt before long they themselves would have to pay at least the tenant's share of the rates.

Catalogues Received.

THE GLOBE PNEUMATIC ENGINEERING COMPANY, LIMITED, 1, Victoria Street, London, S.W.1.—This catalogue has considerable interest for foundrymen, as it deals in an interesting way with air compressors, about which foundrymen cannot know too much.

THE ADAMS COMPANY, Dubuque, Iowa, U.S.A.—A series of pamphlets outlining the different foundry equipment which they manufacture. Amongst their specialities, probably the most interesting is the Farwell moulding machine.

THE WATSON METALLURGICAL COMPANY, Lancaster Street, Sheffield, are this year sending to their friends a handsome Diary for 1923.

J. D. WALLACE & COMPANY, 1401, W. Jackson Boulevard, Chicago, U.S.A.—A handsome illustrated catalogue outlining a number of interesting specialities for the pattern shop, amongst which they show an automatically electrically heated glue-pot. For the foundry there is an electric sifter.

THE C. O. BARTLETT & SNOW COMPANY, Cleveland, Ohio, U.S.A.—A beautifully illustrated catalogue containing photographs and diagrams of typical installations they have erected in various foundries of mechanical sand-handling plants, continuous moulding equipment, and mechanical carrying arrangements.

THE STOIC STEEL & TOOL COMPANY, LIMITED, Self Hard Works, Cornish Street, Sheffield, are paying a first and final dividend of 2s. 1d. in the £.

THE LAST DAY for receiving proofs in connection with a dividend to be paid by Mr. S. Sanders, iron and steel merchant, Lower Cross Street, and Rolfe Street, Smethwick, is December 29.

THE CREDITORS of Mr. H. G. W. Cooling, 10, Market Street, Worksop, joint managing director of Cooling & Lee, Limited, of Worksop, and White Buildings, Fitzalan Square, Sheffield, engineers, met at the Official Receiver's offices, Sheffield on December 13, when they decided to leave the matter in the hands of the Official Receiver. The debtor, who stated that his failure was due to "bad trade and lack of capital," had a deficiency of £373.

Trade Talk.

MR. HENRY MECHAN, of Scotstoun, has given £25,000 for a Chair of Public Health at Glasgow University.

THE LATE MR. A. J. EVANS, proprietor of William Evans, Son, & Company, brass founders, etc., Wolverhampton, left £12,936.

THE YORKSHIRE COPPER WORKS, LIMITED, Leeds, have established a London office at 53, New Broad Street, E.C.2.

LOUDON BROTHERS, LIMITED, have removed from 110, Cannon Street, London, E.C., to Abbey House, 2/8, Victoria Street, S.W.1.

CONSIDERABLE damage was done by a fire which broke out in the dockyard of Scott's Shipbuilding and Engineering Company, Limited.

FREDERICK FOX, LIMITED, engineers, have removed from 76, Thornton Road, Bradford to the Central Ironworks, Bowling Back Lane, Bradford.

MR. F. ROBINSON, of 3, New Street, Birmingham, has been appointed agent in the Midlands for Mullier, Roosen & Company, iron and steel merchants, Brussels.

ALDER AND MACKAY, LIMITED, brass founders and meter manufacturers, of Edinburgh, have removed their London branch to Douglas Street, Westminster, S.W.1.

THE POWER ENGINEERING COMPANY, LIMITED, of Westinghouse Road, Trafford Park, Manchester, have been appointed British agents for the U.S. Smelting Furnace Company, Belleville, Ill.

THE ENTERPRISE ENGINEERING COMPANY, LIMITED, are being wound up voluntarily. Mr. W. R. K. Palk, 56, Newhall Street, Birmingham, has been appointed liquidator.

THE BLYTH SHIPBUILDING AND DRY DOCKS COMPANY, LIMITED, launched four vessels of 11,300 tons and 7,050 i.h.p., in addition to considerable repair work, during the past year.

THE LATE MR. H. G. KING, of Copers Cope Road, Beckenham, Kent, a director of Kasenit, Limited, manufacturers of case hardening materials, Ludgate Square, E.C., left £4,813.

IN CONNECTION with the Yorkshire Association of the Institution of Civil Engineers, Mr. G. B. Jones read a paper on "Corrosion" before a meeting held on December 15 at Leeds.

VICKERS, LIMITED, launched from the Barrow Shipyard this year three vessels of a total gross tonnage of 21,342, and the total horse power constructed was 12,000. The figures for last year were 64,320 tons, and 46,350 horse power.

THE members of the South Wales branch of the Institution of Mechanical Engineers met at Swansea last week, Mr. David E. Roberts (Cardiff) in the chair. A paper was read by Mr. Josiah Butler on "Gas Producers."

W. T. HENLEY'S TELEGRAPH WORKS COMPANY, Limited, Blomfield Street, London Wall, London, E.C.2, have removed their Bristol branch from 56, Victoria Street, to 11, Nelson Street, Bristol. The branch is under the managership of Mr. E. H. Brown.

"MODERN FORGING METHODS" was the subject of a lecture given in the Mappin Hall, Applied Science Department, of the Sheffield University, on December 14, by Mr. J. G. Gillott, in the absence of Mr. A. B. Wilson. The lecture was under the auspices of the Sheffield Tool Trade Technical Society.

IT IS REPORTED that a group of financiers is seeking to effect a combine in the textile machinery industry. The combine, if formed, will, it is rumoured, embrace Platt Bros., Asa Lees & Company, Howard & Bullough, Dobson & Barlow, J. Hetherington & Sons, and possibly two or three smaller concerns.

THE FULLER ENGINEERING COMPANY, 25, Victoria Street, Westminster, London, S.W.1, have obtained another contract for a complete pulverised coal installation to a boiler plant of nearly 5,000 H.P. capacity, and also an order for a further set of their pulverised coal equipment for application to locomotives.

HYAM, LIMITED, 56, Victoria Street, London, S.W.1, have appointed a member of their staff, Mr. G. A. Chapman, to represent them in Manchester and district. The Company's representation for that district was previously held by Martin Bros., Limited, 35, Bridge Street, Manchester.

THE CUNDALL FOLDING MACHINE COMPANY, associated with W. & P., Limited, founders, mechanical and electrical engineers and merchants, have removed their sales office from 240, High Holborn, London, W.C.1, to Fengate, Peterborough. The London representation is in the hands of Russell & Company, 63, Queen Victoria Street, E.C.

LICENCES UNDER THE Non-Ferrous Metal Industry Act, 1918, have been granted to the undermentioned concerns:—H. Bickersteth, trading as Bickersteth, Baker and Company, 17, Water Street, Liverpool; A. Keating, Gorton Street, Rochdale Road, Manchester; Ricard and Freiwald, 120, Fenchurch Street, London, E.C.3; C. W. Taylor and Son, 5, The Green, Darlaston.

DANIEL ADAMSON & COMPANY, LIMITED, turbine engineers and boiler makers, of Dukinfield, announce that their works will be closed for the Christmas holidays from Friday, December 22, until Wednesday, December 27. For the New Year holidays their works will close on Friday, December 29, 1922, until Tuesday, January 2, 1923. No goods will be received or despatched between these dates.

THE CONTRACT for the excavations connected with the large extensions which are to be made by Stewarts and Lloyds, Limited, at their Clydesdale Works, Mossend, has now been placed, and work is about to be started. An order has been placed with Ruston and Hornsby, Limited, of Lincoln, for the supply of two of their excavators mounted on caterpillar tractors. These will be supplemented by three other shovels from the contractors own stockyards.

MR. T. PHILLIPS, secretary of the South Wales and Monmouthshire Iron and Steel Manufacturers' Association, announces that the joint auditors' report for the three months ending November 30 shows a reduction under the sliding scale of 25 per cent., which means that as and from January 1 to March 31, 1923, the wages of the workmen, following the scale, will be 50¾ per cent. above standard as compared with 51 per cent. at present.

THE MEMBERS of the Sheffield Branch of the Institution of British Foundrymen met at the Cutlers' Hall, Sheffield, on December 15, when several types of moulding machines were described. The president, Mr. T. Swinden, who was in the chair, said the meeting had some element of novelty in it, as representatives were present who would describe various types of moulding machines. These were Mr. Daniel Sharpe (Foundry Plant & Machinery Company, Limited, Glasgow), Mr. F. E. Steele (Macdonald & Company, Glasgow), Mr. F. Shearman (Adaptable Moulding Machine Company, Birmingham), and Mr. J. W. Rawlinson (J. W. Jackman & Company, Manchester).

PROFESSOR H. S. HELE-SHAW presided at the seventy-fifth anniversary dinner of the Institution of Mechanical Engineers on December 15. Those present included Sir Charles S. Sherrington, Sir Thomas H. Holland, Mr. William H. Patchell, Major-General Sir H. W. E. Parsons, Sir Richard T. Glazebrooke, Mr. C. T. Musgrave, Mr. David E. Roberts, Mr. Henry Davey, Mr. H. E. Yarrow, Sir Arthur I. Durrant, Lieutenant-Colonel E. Kitson Clark, Sir Herbert J. Creedy, Sir Archibald C. Ross, Sir Robert A. Hadfield, Sir Sydney Chapman, Mr. Daniel Adamson, Mr. L. Sumner, Professor Thomas Turner, and Mr. F. W. Harbord.

THE ENGINEERS' SECTION SUB-COMMITTEE of the Committee for the Relief of Russian Intellectuals, of which Sir Robert Hadfield, Bart., is hon. president, and Professor H. C. H. Carpenter honorary vice-president, are making an appeal on behalf of Russian engineers. So serious are the conditions under which Russian men of science are placed and so pressing their wants that the members of the committee feel it incumbent upon them to bring to the notice of members of the British engineering profession the acute distress prevailing amongst their colleagues in Russia. Amongst the sufferers, there are many families of members of the civil, electrical, mechanical, mining engineers and metallurgists. Their plight is heart-rending, for owing to the stagnation of industry there is almost a total lack of employment. The hon. treasurer of the fund is Mr. R. C. Griffith, 3, Victoria Avenue, Bishopsgate, E.C.2.

A MEETING of the Welsh Engineers and Allied Trades Conciliation Board was held at Swansea on December 15 to further consider the question of the demand for wage reductions, submitted some time ago, which would affect craftsmen and semi-skilled men employed at the foundries located between Port Talbot and Llanelly, and craftsmen employed at the South Wales tinplate works and Siemens steelworks. After discussion the employers made an offer which they desired to impress upon the men's representatives must be accepted as final:—That skilled men be paid as from January 1, 1923, and be operative to the end of June, £3 7s. 6d. per week, or a reduction of 6s. per week, and unskilled £2 10s. per week, or a reduction of 5s. per week. Failing acceptance, arbitration in accordance with the constitution of the Conciliation Board. The delegates agreed to recommend the acceptance of the conditions offered to the men, who are instructed to ballot upon acceptance or arbitration.

Taberg Iron Ore.—According to a Swedish report the Germans are again taking an interest in Taberg iron ore. Mining at Taberg ceased at the end of last century, and German interests have more than once planned a resumption of activity. It is intended to transport the ore to Germany, or possibly to smelt it at Halmstad. The Nässjoe Railway, it is stated, would be able to transport 1,000 tons daily to Halmstad.

IRON AND STEEL MARKETS.

Pig-iron.

The concluding markets for the year have brought little change in the pig-iron position, which remains as previously reported, firm with a steady expansion in home consumptive demand, and a by no means negligible, if diminished, volume of export trade. That there is an increased inquiry for foundry iron is unquestionably evidenced in the Lancashire area, an important centre of that particular industry, the Manchester market for pig showing a distinct if slow improvement, though buying is, as yet, only on a limited scale. In this district, as in others, hopes were entertained by consumers of some reduction in quotations, consequent upon the recent revision of rail transport rates in a downward direction. Smelters, on the other hand, contend that production costs hitherto have precluded anything like remunerative working, and that any small saving effected by the cheaper terms for carriage of raw material, etc., should be to the advantage of the producer. Here also there is a tendency to increase in the competition of the Northamptonshire with Derbyshire foundry iron, resulting from the lower railway carriage from the farther sources of supply, but this is not yet very noticeable. The feeling that pig-iron is now at about the lowest level which it is likely to reach is perhaps attributable to the fact that for a long time there has been no "bear" selling of iron in this or indeed in any other district. One does not find people interested in depressing the value of pig-iron, and hence opinion is all one way. At Birmingham market last week fairly satisfactory reports were heard concerning foundry iron, demand for which is on an increasing scale, and quotations are very firm. Altogether conditions look much more promising than they have done for a long time. Quotations :—Northamptonshire forge iron, 70s. to 72s. 6d.; No. 3 foundry, 77s. 6d. to 80s.; Derbyshire forge, 75s.; No. 3 foundry, 82s. 6d.; all f.o.t. furnaces. The Cleveland iron market has been much quieter as the close of the year draws near, and stocks in makers' yards have tended to accumulate, more especially in the case of forge and foundry qualities. Prices have accordingly weakened to a slight extent, No. 1 and silicious being quoted at 95s., and No. 3 G.M.B. at 91s., though some makers are holding out for 92s. No. 4 foundry is at about 85s., and No. 4 forge at 82s. 6d.

The demand for hematite continues unabated, and it is occasionally difficult to obtain prompt deliveries, the increased production of steel practically absorbing current outputs. Prices consequently show a firmer tendency all round, with last week's quotations ruling for East Coast mixed numbers at 93s., with a premium of from 6d. to 1s. per ton for No. 1 quality, while West Cumberland Bessemer brands remain steadily at 105s. to 110s., delivered Glasgow or Sheffield.

Finished Iron.

A distinctly more cheerful note was sounded at last week's meeting of the South Staffordshire iron trade, and as far as finished material is concerned the prevailing impression appeared to be that conditions are at last improving. Perhaps the most conclusive evidence on the point is furnished by the fact that manufacturers are beginning to get some accumulation of orders on their books. That is the most encouraging and hopeful sign as to the future which it is possible to have. For a very long time now consumers have been buying from hand to mouth. That they have changed their attitude is due to two things—their own order books are more healthy, and a feeling that the market has reached bottom. Marked bar makers are fairly well off for orders, and quotations for these qualities remain remarkably firm and steady, foreign competition affecting more directly producers of the commoner brands of iron. There is now a somewhat improved demand for crown quality bars, but business in this section is far from being as brisk as could be desired. Quotations all round remain firm at previous levels.

Steel.

After a period of unprecedented depression, it is satisfactory to report that the close of 1922 marks an improvement in the conditions of the steel trade of the country, as evidenced in a welcome revival of home demand and a corresponding movement in the export business passing. Further progress in the last-named direction will undoubtedly be accelerated by the exchange position on the Continent, few of the Belgian or French works caring to accept anything but comparatively small orders, and those for delivery early next year. As a result, some business has been diverted to British steel works, although a greater tonnage of orders has been held in suspense pending a possible revival of Continental competition. As the home steel markets will be practically closed over the next fortnight for holiday and stock-taking purposes, current business will be almost entirely suspended, but quotations are generally firm without much expectation of any change of importance in the meantime. In the ferro-alloy market silico-manganese has been inquired for in fair quantities, and the price is firm, ruling about £17 per ton for material showing 50/55 per cent. Mn contained. For higher content, the price appreciates at approximately 2s. per unit increase in the Mn. contained The silicon contained is generally between 20 and 25 per cent., although material showing only 15/20 per cent. Si has been asked for. The demand for tinplates continues steady, and makers have decided, owing to the advance in the price of steel, to fix the minimum price at 20s. per standard box f.o.b. Bristol Channel ports, for future delivery.

Scrap.

There is very little to add to previous reports on the conditions in the scrap metal trade, business everywhere having quietened down in view of the impending holidays, but with a distinctly better outlook than could have been anticipated a short time ago. The firmness of prices for certain qualities of iron and steel scrap noted of late is well maintained, as expressed in the following quotations for sales recently effected in the Middlesbrough market. Prices for heavy steel scrap are 68s. 6d. per ton; heavy cast-iron scrap, machinery quality, in handy pieces, 75s. to 77s. 6d. per ton, delivered works; good heavy steel turnings and good clean cast-iron borings, 55s. per ton, delivered works; heavy wrought-iron scrap, ordinary piling quality, 72s. 6d. per ton, delivered works; and good heavy forge iron scrap is quoted 80s. per ton.

How the A.F.A. Papers are Produced.

Whilst the difference between the Institution of British Foundrymen and the American Foundrymen's Association is patent on account of one catering for a continent and the other a country, the fundamental difference is narrowing, as a perusal of the I.B.F. list of members will show. It includes now Indian, Australian, American, French, Belgian and Spanish adherents; and such people may like, but fear, to ask permission to present a Paper. Thus excellent work may never come to light. Our American cousins overcome this difficulty by issuing to all members the following form:—

RETURN BLANK.

To the Secretary of the Papers Committee,
American Foundrymen's Association.

The undersigned hereby offers to present a Paper on .....
.....
.....
at the annual meeting of the Association to be held in the Spring of 1923.

It is understood that the acceptance of this offer does not imply an obligation to accept the Paper if it should fail to conform to the Regulations Governing Papers.

The undersigned expects to be able to furnish the manuscript of the Paper complete (including tabular matter and illustrations, if any) within (name shortest time).....weeks from the date of the receipt of the acceptance of this offer.

It is suggested that the following persons (give names and addresses) be invited to open a discussion on the above subject:—
.....
.....

It is also suggested that the following persons (give names and addresses) be requested to present Papers on the subjects named below:—
.....
.....
.....
.....

The following are suggested as desirable subjects for a Paper or Discussion:—
.....
.....
.....

Signed.....

You are urged to lend your co-operation by filling out this blank and mailing to the address above as promptly as possible.

The British Cast Iron Research Association.

Progress of Research Work in Hand.

In his monthly circular the director, Dr. Percy Longmuir, states that during December arrangements have been made for the early prosecution of definite and systematic research on some of the fundamental properties of cast iron.

The range of irons to be examined in the first place will include the full run of commercial grey irons and semi-steels. Special reference will be given to liquid shrinkage and solid contraction as outlined in Research No. 8—"Shrinkage Defects."

This side of the work will be further supplemented by a correlation of chemical, mechanical, physical, thermal, structural, and magnetic properties.

In reference to thermal properties, it is intended specially to investigate volume changes due to temperature, the critical ranges and the effect of initial temperature on these ranges, and to follow up with a systematic investigation of the physical properties of commercial grey cast irons at temperatures higher and lower than atmospheric. This, when completed, will give results of real and direct value in the case of all types of castings which in working life are subjected to abnormal temperatures. These studies will also include the effect of repeated reheating, and the practical foundry value will lie in the direction of developing types of cast iron adaptable for abnormal temperature working conditions.

An opposite property, that of resistance offered to various corrosive agents, will also be studied, and at the request of one member special reference will be given to the action of sea water on cast iron. As this section progresses it is hoped to examine the special alloy cast irons and later to investigate the possibilities of machinable non-corrosive cast irons.

The work contemplated is extensive and will naturally occupy a considerable time. However, the very willing offers of co-operation already received will go far in facilitating real progress. When complete the work will present evidence of practical foundry value. Further, this work will pave the way to a systematic study of the white irons and malleabilisation.

In the meantime, a preliminary investigation is being conducted on some of the difficulties of malleable cast-iron practice, and the results will be issued to members in due course.

Problems Sent in by Members.

Minor investigations in regard to members' difficulties are being actively followed, and in this respect the Director will welcome suggestions and instances of either abnormal melting practice or abnormal castings. Reports have been made to members during the past month upon the following problems: Semi-steel difficulties; mixtures for semi-Diesel engine castings; cast-iron tank plates; malleable cycle-hub castings; cast-iron carburettor castings; physical properties of malleable cast iron; mixture for cast-iron cylinders.

Membership.

During the past month further new members were elected. The support the Association is now obtaining is very gratifying evidence that the industry is waking up to its responsibilities. A new booklet has now been issued giving the full conditions of membership, which will be forwarded to any foundry interested.

Deaths.

MR. B. S. BROADHURST, managing director of the Brush Electrical Engineering Company, Limited, died on December 11.

MR. SHELPER, commercial manager to the Crown Preserved Coal Company, Limited, of Cardiff, died recently in his 49th year.

MR. C. F. G. GOUGH, managing director of the Fairwood Tinplate Company, Limited, died recently at his residence at Gower, near Swansea.

MR. T. L. GREENWOOD, of Edgedale Road, Sheffield, secretary of the firm of T. W. Ward, Limited, Albion Works, has died in Sheffield after an operation. Mr. Greenwood has been secretary of the company since its incorporation in 1921.

Company News.

J. Atkinson & Company, Limited, 11, Blackfriars Road, Salford, Manchester.—Capital £5,000 in £1 shares. Metal merchants. Directors: J. H. Atkinson, C. F. Atkinson and J. R. Wallwork.

Atlas Engineering & Foundry Company, Limited.—Loss, £13,791; brought in, £3,992; debit balance carried forward, £9,798.

Busk Textile Machinists, Limited.—Capital £1,000. Directors: A. W. Thomas (permanent governing director) and R. J. Thomas.

Bertrams, Limited.—Brought forward, £5,084; net profits, £9,889; dividend, 10 per cent.; depreciation account, £3,000; carry forward, £2,389.

E. Binns & Sons, Limited, West Vale, near Halifax.—Capital £5,000 in £1 shares (2,000 6 per cent. cumulative preference). Millwrights and mechanics. Permanent director: J. E. Binns.

Channel Steel Company, Limited.—Debit to administrative and other expenditure account increased from £21,094 to £22,032. During year directors unable proceed with development of properties, but matter now having attention.

Eltringhams, Limited.—Profit, £21,999; depreciation, £11,522; set aside for E.P.D., corporation profits tax and income tax, £30,887; adverse balance, £20,480; brought forward, £39,435; credit balance carried forward, £18,955.

Gibbons (Dudley), Limited.—Further interim ordinary dividend, 3½ per cent., making 7 per cent. for year, free of tax.

James Hinks & Son, Limited.—Net loss for year, £6,027; credit balance brought in converted into debit, £2,576. Loss arrived at after including £13,176 E.P.D. recoverable and £36,880 taxation reserve no longer required.

Howard & Bullough, Limited.—Quarterly dividend, 6d. per share, less tax, on ordinary and preference.

Milners' Safe Company, Limited.—Interim dividend, 2½ per cent., less tax.

G. D. Peters & Company, Limited.—Quarterly preference dividend, 6 per cent. per annum, less tax.

Ropner Shipbuilding & Repairing Company (Stockton), Limited.—Capital £200,000 in 5s. shares (600,000 preferred ordinary and 200,000 deferred ordinary), to adopt agreements with the Ropner Shipbuilding and Repairing Company (Stockton), Limited (in liquidation), and J. G. Johnson. Directors: Sir William H. Seager, Lord Glanely, Sir William Reardon Smith, Bart., John Cory, W. Leon, T. H. Mordey, T. E. Morel, Sir Archibald Mitchelson, Bart., E. H. O. R. Ropner, jun., and Leonard Ropner. Secretary: H. J. Fowler.

John Spencer & Sons, Limited.—Credit balance, including £42,038 brought forward, £30,738; renewals and improvements expenditure, £15,000; carry forward, £15,738.

Taft-Peirce Company, Limited, 2, Gresham Buildings, Basinghall Street, London, E.C.2.—Capital £100. Civil and mechanical engineers, etc. Permanent directors: F. S. Blackall, G. Gordon and F. W. G. Snook.

F. E. Vickers & Company, Limited, 23, Telegraph Buildings, Sheffield.—Capital £1,000 in £1 shares. Mechanical, electrical and general engineers. Directors: R. H. Piggford (managing) and F. Vickers.

Contracts Open.

Bradford, January 1.—Stores, for the Tramways Committee. Mr. R. H. Wilkinson, tramways general manager, 7, Hall Ings.

Dublin, January 4.—Supply of aluminium, brass, etc., lead and spelter castings, etc., for the Commissioners of Irish Lights, Dublin. Mr. J. B. Phelps, secretary.

Llandebie, January 4.—Supply of cast-iron pipes, valves, fittings, etc., for the Llandilofawr Rural District Council. Mr. G. H. Davies, College Street, Ammanford. (Fee, £5 5s., returnable.)

New Hunstanton, January 3.—Supply of 80 tons of 6-in., 4-in., and 3-in. cast-iron S. and S. pipes and specials to comply with the British standard specification, Class "B," for the New Hunstanton Urban District Council. Mr. F. Wilkinson, engineer and surveyor, Town Hall, Hunstanton.

Okehampton, January 8.—Supply, laying and jointing of about 1,000 yards of 5-in. and 4-in. cast-iron socket pipes, etc., for the Town Council. Nichols & Unwin, 11, Victoria Street, Westminster, S.W.1 (Fee, £2, returnable.)

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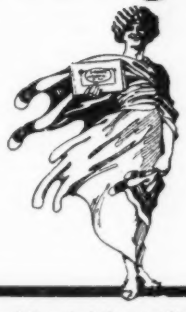
Natural Draught with costly brick chimney emitting black smoke that spells waste and the draught at the mercy of the atmospheric conditions.



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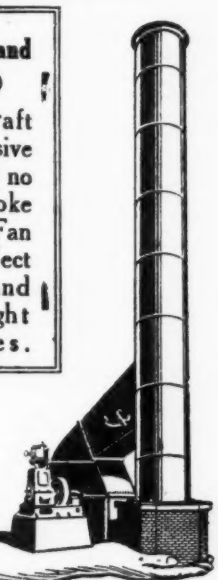
SIROCCO

Induced Draft with inexpensive steel stack and no wasteful smoke because the Fan ensures perfect combustion and correct draught at all times.



DAVIDSON & Co LTD.
SIROCCO WORKS,
BELFAST.
TRADE
SIROCCO
MARK

GANISTER, CUPOLA BLOCKS, FIRE BRICKS, FIRE CLAY.

Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

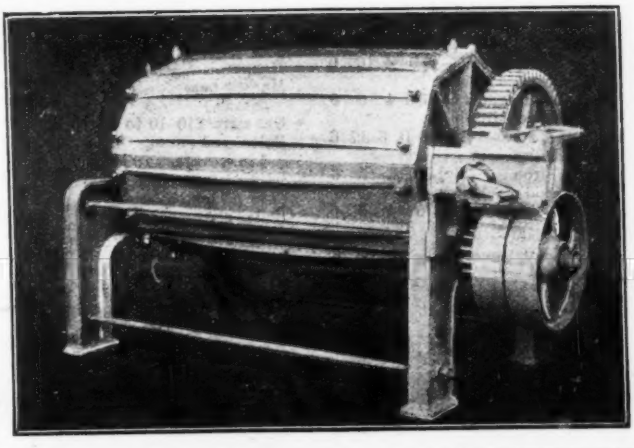
J. GRAYSON LOWOOD & Co., Ltd.,
DEEPCAR, nr. SHEFFIELD.

Telegrams: "LOWOOD, DEEPCAR."

HALL & LUND BROS.,

OTLEY STREET.
KEIGHLEY.

FOUNDRY ENGINEERS.



SPECIALITIES:—

TUMBLING BARRELS.

MOULDING MACHINES.

POWER RIDDLES.

EMERY GRINDERS.

SEND FOR FULL PARTICULARS.

WEEKLY PRICE CURRENT.

COPPER.

	£	s	d.
Standard cash	64	12	6
Three months	65	7	6
Electrolytic	71	12	6
Tough	67	10	0
Best selected	67	10	0
Sheets	96	0	0
India	84	0	0
Wire bars	71	15	0
Do. Jan.	71	15	0
Do. Feb.	71	15	0
Ingot bars	71	15	0
H.C. wire rods	75	10	0
Off. aver. cash, Nov.	62	17	0 5/11
Do. 3 mths., Nov.	63	14	3 1/11
Do. Settlement Nov.	62	17	1 10/11
Do. Electro, Nov.	70	9	3 5/11
Do. B.S., Nov. ..	66	8	9
Aver. spot price, copper, Nov. ..	62	16	1 3/4
Do. Electro, Nov.	70	14	3 1/2

Solid drawn tubes .. 13½d.
Brazed tubes .. .. 13½d.
Wire .. .. .. 10½d.
Yellow metal rods .. 6½d.
Do. 4x4 Squares .. 8½d.
Do. 4x3 Sheets .. 9½d

BRASS.

Solid drawn tubes .. 11½d.
Brazed tubes 13½d
Rods, drawn .. .. 10½d.
Rods, extruded or rolled 6½d.
Sheets to 10 w.g. .. 10d.
Wire .. .. .. 9½d.
Rolled metal .. 9½d.

TIN.

Standard cash ..	182	2	6
Three Months ..	183	10	0
English	182	5	0
Bars	184	5	0
Chinese	179	10	0
Straits	183	15	0
Australian	183	10	0
Eastern	183	5	0
Banca	182	15	0
Off. aver., cash, Nov.	179	8	9 1/2
Do. 3 mths., Nov.	180	3	5 1/2
Do. Sttlment Nov.	179	8	7 7/11
Aver. spot, Nov...	179	7	3½

SPELTER.

Ordinary	37	7	6
Remelted	35	10	0
Hard	28	0	0
Electro 99.9	42	10	0
English	38	5	0
India	29	0	0
Prime Western ..	38	5	0
Zinc dust	49	0	0
Zinc ashes	11	0	0
Off. aver., Nov. ..	36	18	9
Aver., spot, Nov. ..	38	0	2½

LEAD.

Soft foreign ppt ..	26	7	6
English	27	10	0
Off. average, Nov.	25	12	2 13/22
Average spot, Nov.	26	3	5½

ZINC SHEETS, &c.

Zinc sheets, English	42	0	0
Do. V.M. ex. whf.	43	0	0
Dutch	43	0	0
Rods	50	0	0
Boiler plates	41	0	0
Battery plates ..	43	0	0

ANTIMONY.

English regulus ..	27	0	0
Special brands ..	33	10	0
Chinese	25	0	0
Crude	17	0	0

QUICKSILVER.

Quicksilver 12 2 6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—
45/50% 11 17 6
75% 20 10 0

Ferro-vanadium—
35/40% 17/- lb. va.

Ferro-molybdenum—
70/75% c. free 9/6 lb. mo.

Ferro-titanium—
23/25%, carbonless 1/1½ lb.

Ferro-phosphorus, 20/23%, £24

Ferro-tungsten—
80/85%, carbon free 1/5 lb.

Tungsten metal powder—
98/99% .. .. 1/11 lb.

Ferro-chrome—
4/6% car. £23 10
6/8% car. £22 10
8/10% car. .. £21 5

Ferro-chrome—
Max. 2% car. .. £54 0
Max. 1% car. .. £65 0
Max. 0.70% car. .. £73 0
67/70%, carbonless 1/7 lb.

Nickel—99%, cubes or pellets .. £130 0

Cobalt metal—98/99% 11/6 lb.

Aluminium—98/99% £95

Metallic Chromium—
96/98% .. .. 4/6 lb.

Ferro-manganese(net)—
76/80%, loose .. £15
76/80%, packed .. £16
76/80%, export .. £14 10

Metallic manganese—
94/96%, carbonless 2/3 lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten .. .. s. d. 2 6
Finished bars, 18% tungsten 3 0
Per lb. net, d/d buyers' works.

Extras—
Rounds and squares 3 in. to 8 in. inclusive 4d. lb.
Rounds and squares under ½ in. to ¼ in. 3d. lb.
Flats under 1 in. by ¾ in. to ¼ in. by ¼ in., and all sizes over four times in width over thickness .. .. 3d. lb.
Bevels of approved sizes and sections .. 6d. lb.
If in coils .. .. 3d. lb.
Packing .. ..£3 ton.
Bars cut to length 10% extra

Scrap from high-speed tool steel—
Scrap pieces .. .. 3d.
Turnings and swarf .. 1d.
Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—	£	s.	d.	£	s.	d
Heavy Steel	4	0	0	4	10	0
Bundled steel & shearings	3	5	0	4	0	0
Mixed iron & steel ..	3	10	0	3	17	6
Heavy cast iron ..	3	15	0	3	17	6
Good machinery for foundries	3	15	0	4	5	0

Cleveland—			
Heavy steel ..	3	8	6
Steel turnings ..	2	16	0
Cast-iron borings	2	16	0
Heavy forge ..	4	2	6
Bushelled scrap ..	3	12	6
Cast-iron scrap ..	3	16	0

Lancashire—			
Cast iron scrap ..	4	0	0
Heavy wrought ..	3	10	0
Steel turnings ..	2	7	6

London—	£	s.	d
Copper (clean) ..	37	0	0
Brass (clean) ..	32	0	0
Lead (less usual draft)	23	0	0
Tea lead	20	0	0
Zinc	22	10	0
New aluminium cuttings ..	64	0	0
Braziery copper ..	48	0	0
Gun metal ..	44	0	0
Hollow pewter ..	150	0	0
Shaped black pewter	90	0	0

Above are merchant's buying prices delivered yard.

PIG-IRON.

N. E. Coast—
Foundry No. 1 .. 95/-
Foundry No. 3 .. 91/-
Forge No. 4 .. .. 82/6
Mottled 80/-
Hematite No. 1 .. 93/9
Hematite M/Nos. .. 93/-

Midlands—
Staffs. common .. —
„ part-mine forge —
„ „ foundry —
„ Cold blast, ord. 190/-
„ „ roll iron 200/-
„ basic .. .. —
Northants forge 70/- to 72/6
„ foundry No. 3 77/6 „ 80/-
„ basic 80/-
Derbyshire forge .. 75/-
„ foundry No. 3 82/6
„ basic .. 80/-

Scotland—
Foundry No. 1 .. 99/6
„ No. 3 .. 94/6
Hematite M/Nos. .. 105/-

Sheffield (d/d district)—
Derby forge 85/6
„ foundry No. 3 87/6
Lincs. forge 86/6
„ foundry No. 3 90/-
„ basic 86/6
E.C. hematite .. 104/2
W.C. hematite .. 105/-
All d/d in the district.

Lancashire (d/d eq. Man.) —
Derby forge .. .. —
„ foundry No. 3 90/-
Northants foundry No. 3 .. .. —
Cleveland foundry No. 3 .. .. —
Staffs. foundry No. 3 —
Lincs. forge .. .. —
„ foundry No. 3 —
Summerlee foundry .. 109/6
Glengarnock foundry 111/6
Gartsherrie foundry 111/6
Monkland foundry .. 109/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.
Bars (cr.)	£10 10 to 11	10	0
Angles	£10 15 to 11	15	0
Tees to 3 united ins.	£11 to £12		
Nut and bolt ..	9	12	6
Hoops	14	0	0
Marked bars (Staffs.) ..	13	10	0
Gas strip	£10 10 to 10	15	0
Bolts and nuts, ¾ in. × 4 in.	16	10	0

Steel—			
Ship plates	£9 to 9	10	0
Boiler plates ..	12	10	0
Chequer plates	10	5	0
Angles	£8 12 6 to	9	0 0
Tees	£9 12 6 to	10	0 0
Channels ..	8	10	0
Joists	9	0	0
Rounds & squares 3-in. to 5½in. ..	9	10	0
Rounds, under 3in. to ¾in. ..	9	0	0
Flats, over 5in. wide and up ..	9	15	0
Flats 5in. to 1¼in.	9	0	0

	£	s.	d.
Rails, heavy ..	8	15	0
Fishplates ..	13	10	0
Hoops	11	10	0
Black sheets, 24 g.	11	15	0
Galv. cor. sheets, 24 g.	17	7	6
Galv. fencing wire, 8 g. plain ..	16	0	0
Rivets, ¼ in. dia	11	15	0
Billets, soft	6 10 0 to 7	0	0
Billets, hard	7 0 0 to 8	0	0
Sheet bars	6 17 6 to 7	0	0
Tin bars	7 7 6 to 7	13	9

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 3
Sheet	1 3½
Wire	1 3½
Rods	1 2½
Tubes	1 6
Castings	1 1

Delivery 3 cwt. free to any town.
10% phosphor copper, £40 above price of B.S.
15% phosphor copper, £50 above price of B.S.
Phosphor tin (5%), £30 above price of English ingots.

CHARLES CLIFFORD & SON LIMITED, BIRMINGHAM.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	11d. to 1/5
Rolled—	
To 9 in. wide	1/5 to 1/11
To 12 in. wide	1/5½ to 1/11½
To 15 in. wide	1/6 to 2/0
To 18 in. wide	1/6½ to 2/0½
To 21 in. wide	1/7½ to 2/1½
To 25 in. wide	1/8½ to 2/2½
Ingots for spoons and forks ..	11d. to 1/5
Ingots rolled to spoon size ..	1/2 to 1/8
Wire round—	
3/0 to 10. G. ..	1/8½ to 2/3½

with extras according to guage.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	28 75
No. 2 foundry Valley ..	25.00
No. 2 foundry, Birm. ..	22.50
Basic	26.96
Bessemer	29.27
Malleable	27.96
Grey forge	26.77
Ferro-manganese 80 % delivered	100.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y, at mill	43.00
Bess. billets	36.50
O.-h. billets	36 50
O.-h. sheet bars ..	36.50
Wire rods	45.00

	Cents.
Iron bars, Phila. ..	2.27
Steel bars	2.00
Tank plates	1.95
Beams, etc.	2.00
Skelp, grooved steel ..	2.00
Skelp, sheared steel ..	2.00
Steel hoops	2.75
Sheets, black, No. 28 ..	3.35
Sheets, galv., No. 28 ..	4.35
Sheets, blue an'l'd, 9&10	2.50
Wire nails	2.70
Plain wire	2.45
Barbed wire, galv. ..	3.35
Tinplate, 100-lb. box ..	$4.75

COKE (at ovens).

Welsh foundry 35/-
„ furnace 25/-
Durham & North fdy. 27/6 to 30/-
„ furnace 22/6 to 25/6
Other Districts, foundry 25/- to 30/-
„ furnace 21/6 to 24 6

SWEDISH IRON.

Bars, hammered basis sizes Basis price £22 to £23

	£ s. d.
Rolled Ordinary— Assortment ..	18 0 0
Nail Rods— Square, round and flats ..	to 18 10 0

Keg Steel nom. £38 to £40
Faggot Steel nom. £30 to £32

Blooms—
Single welded .. £10 to £11

Billets—
Single and double welded £13 to £14

Pig-Iron—
Grey, white or mottled .. £7 to £7 10 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

Up to and incl. 6 in.

Gas	.. 57½%	Tube prices are now free.
Water	.. 52½%	
Steam	.. 47½%	

TINPLATES.

I.C.Cokes,	20×14, box		20/3
„	28×20,	„	41/–
„	20×10,	„	29/6
„	18¾×14,	„	20/10½
I.X.		„	47/–
I.X.X.		„	53/–
F.C.B.Y.	21×13½	„	38/–
C.V.B.G.	16¾×15,	„	36/–
I.C.W.	20×14,	„	18/7½
„	28×20,	„	37/–
„	20×10,	„	26/4½
„	18¾×14,	„	19/–
Terneplates,	28×20,	„	36 9

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
Dec. 20	64	5	0	inc.	5/–
„ 21	64	5	0	No change	
„ 22	64	5	0	„	
„ 26	—	—	—		—
„ 27	64	12	6	inc.	7/6

Electrolytic Copper.

Dec. 20	71	5	0	inc.	15/–
„ 21	71	12	6	„	7/6
„ 22	71	12	6	No change	
„ 26	—	—	—		—
„ 27	71	12	6	No change	

Standard Tin (cash).

Dec. 20	179	0	0	dec.	20/–
„ 21	179	12	6	inc.	12/6
„ 22	180	17	6	„	25/–
„ 26	—	—	—		—
„ 27	182	2	6	inc.	25/–

Tin (English ingots)

Dec. 20	179	0	0	dec.	20/–
„ 21	179	15	0	inc.	15/–
„ 22	181	0	0	„	25/–
„ 26	—	—	—		—
„ 27	182	5	0	inc.	25/–

Zinc Sheets (English).

Dec. 20	42	0	0	No change
„ 21	42	0	0	„
„ 22	42	0	0	„
„ 26	—	—	—	—
„ 27	42	0	0	„

Spelter (ordinary).

Dec. 20	37	5	0		—
„ 21	37	2	6	dec.	2/6
„ 22	37	10	0	inc.	7/6
„ 26	—	—	—		—
„ 27	37	7	6	dec.	2/6

Lead (English)

Dec. 20	27	10	0	inc.	10/–
„ 21	27	10	0	No change	
„ 22	27	10	0	„	
„ 26	—	—	—		—
„ 27	27	10	0	No change	

THE
ARMITAGE WORKS Co., Ltd.
Manufacturers of
Highly Refractory Bricks and Blocks
FOR ALL PURPOSES.

SPECIALITIES:
CUPOLA LININGS.
Ladle Bricks for Siemens Ladles.
Chequer Bricks, etc., for Siemens Furnaces.
Gas Producer Linings.

GROUND GANISTER
for Iron, Steel, and Brass Furnaces. Forced Draught Brass Furnaces. Semi-Silica or Semi-Ganister Bricks. Silica Cement.

DEEPCAR, Near Sheffield.

SHROPSHIRE IRON Co., Ltd.

Works:— Hadley, Shropshire.
London:—10, Bush Lane Cannon St., E.C.4.

Telegrams:— Sun, Wellington, Salop. Sunbrand (Cannon), London.
Telephone:— 11 Wellington, Salop. 5959 Central.

BARS, HOOPS, SECTIONS & WIRE
in IRON, STEEL, COPPER and BRONZE.

Galvanised Telegraph, Telephone, Cable and Trolley Wire
To all Specifications.

Contractors to H.M. Government (Admiralty, G.P.O., India Office, War Office, Colonies), English and Foreign Railways, &c.

BEST H. C. COPPER & BRONZE WIRE a speciality.

Medals:—Sydney (Bronze) 1879, New Zealand (Gold) 1882, Liverpool (Silver) 1886, Adelaide (Gold) 1887, Franco-British Grand Prix (Highest Award) 1908.

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT
5, MURZBAN ROAD, BOMBAY.
1, LALL BAZAR CALCUTTA.

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5 SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.

PIG IRON
SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.
IRON & STEEL SCRAP
COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,
ROYAL EXCHANGE, MIDDLESBROUGH.
93, HOPE STREET, GLASGOW.

SITUATIONS VACANT AND WANTED.

LATE PRODUCTION MANAGER of well-known firm desires position; experience in Engine and Ordnance Work, Colliery and General Engineering.—Apply, W. LAING, 4, Main Road, Handsworth, Sheffield.

THE Lancashire Branch of the Institution of British Foundrymen beg to announce that several members, who have had varied experience as Foremen, etc., are at present disengaged. Employers who are in need of Foremen or other members of their foundry staff are invited to communicate with the Honorary Secretary, T. MAKEMSON, 21, Beresford Road, Stretford, Manchester

SITUATION required as Steel Moulder; active, strong and healthy; age 50 years; 22 years in last situation, 10 years as under-foreman; shop doing approx. 50 to 80 tons per week; castings to 3 tons; general engineering and locomotive; able to take charge. Member of F.M.B.S.; no other society.—Box, 314, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Strand, London, W.C.2.

WANTED.—FOUNDRY FOREMAN, experienced in moulding large marine castings and general heavy machine tool castings.—Apply, THE SHEEPBRIDGE COAL & IRON COMPANY, LIMITED, Chesterfield.

WANTED, Foreman for Aluminium Foundry. Must have good experience in this metal and be good organiser, with intimate knowledge of modern machine moulding. Only keen men need apply.—Box 312, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED.—FOREMAN PATTERNMAKER, experienced in heavy marine engine, general machine tools and special pipe patterns.—Apply, THE SHEEPBRIDGE COAL & IRON COMPANY, LIMITED, Chesterfield.

FOUNDRY FOREMAN wanted immediately to take charge of large Foundry engaged on repetition work. Must be thoroughly conversant with the latest Machine moulding practice, and the economical working of Cupolas. Applicants to state Age, Experience and Salary required, and to furnish references as to ability and character.—Apply, Box 318, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, Adelphi, Strand, London, W.C.2.

AGENCIES.

THE Manufacturers of the most up-to-date Moulding Machines in the world, who have over 16,000 Machines at work in the various Countries of the Universe, desire well accredited and energetic Selling Agents in all British Colonies and Possessions for the sale of their Moulding Machines, and all Foundry Plant. In reply please write to THE UNIVERSAL SYSTEM OF MACHINE MOULDING & MACHINERY COMPANY, LIMITED, 97, Queen Victoria Street, London, E.C.4.

PATENT.

ADVICE and Handbook Free.—KING'S PATENT AGENCY, LIMITED, Director, B. T. King, Reg. Patent Agent, 146a, Queen Victoria Street, E.C.4.

MACHINERY.

NINE nearly new Steel Hopper Wagons, standard gauge, roller bearings.

Two sets of Belt-driven Geared Hydraulic Pumps, 2-in. rams and 4-in. rams.

Brand new 4-ft. under-driven Sand Mill.

10-kw. Steam-driven Lighting Set, 110 volts D.C.; bargains.

HARRY H. GARDAM & COMPANY, LIMITED, STAINES.

CASTINGS.

Modern Foundry equipped for weights up to 10 or 12 tons. Keen prices. Best quality.

Enquiries solicited for pattern making. Good deliveries.

Wm. ASQUITH (1920), Ld.

Highroad Wells Road - - - - HALIFAX.

MACHINERY.—*Contd.*

TWO Cross Compound Horizontal Drop Valve Engines, 12½ in. and 20-in. cyls., 26 in. stroke, by Robey & Company, Limited. Cross Compound Horizontal Condensing Engine, 11½ in. and 17½ in. cyls., 18 in. stroke, by Marshall, Sons & Company, Limited. Vertical Compound Open Type Engine, 12 in. and 19 in. cyls., 12 in. stroke, by Tangyes, Limited. Nearly New Surface Condensing Plant, by F. Pearn & Company, surface area of tubes about 1,200 ft., compound engine, etc. Ingersoll Sergeant Direct Line Steam Driven Air Compressor, 14¼ in. air cyl., 14 in. steam, 14 in. stroke, capacity 384 cub. ft. free air per minute. Vertical Three-Throw Geared and Belt-Driven Hydraulic Pump, by H. Berry & Company, 2½ in. rams, 6 in. stroke, working pressure 1,500 lbs. 4 ft. Arm Bickford Radial Drilling Machine, 3 in. balanced spindle, T slotted low base 4 ft. by 3 ft. Four 3 ft. 4 in. Cold Iron Band Sawing Machines, by Noble & Lund, two T slotted tables 3 ft. 9 in. by 1 ft. 9 in. Vertical Boring and Turning Mill, with 50-in. table, two tool boxes on cross slide, by the Bridgeport Machine Tool Works, Limited. Horizontal Boring Machine, by the Lucas Machine Tool Company, 3-in. spindle, T slotted table 3 ft. 6 in. by 1 ft. 10 in.

Catalogue of Stock Machinery, 6,000 Lots, Free on application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS, SHEFFIELD.

COMPLETE New Portable Cutting Plant, £15 10s.; approval. Welding Plant, with six blowpipes, £22, including expert tuition at customer's works; approval. Cutting Blowpipes, unused, but soiled, £3; 1922 pattern.—STANSELL'S ACETYLENE COMPANY, LIMITED, Exeter.

PROPERTY.

A FULLY Equipped Foundry in London District, capable of turning out 15 to 20 Tons per week, also up-to-date Engineers (fully equipped) in connection with same. To be sold. Both with good connections. Strictest investigation. For further particulars apply to MR. F. B. HEYWOOD, Messrs. Heywood, Harvey & Company, 9-10, Balfour House, Finsbury Pavement, E.C.

MISCELLANEOUS.

OLD Burnt Cast Iron Annealing Stands and Firebars, and Old Burnt W.I. and/or Steel Annealing Pots for sale, regular supplies. Best offers to.—Box 316, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, Adelphi, Strand, London, W.C.2.

FOUNDRY REQUISITES.

Try our REFRACTORIES.

Ganister or Silica Bricks and Blocks (any shape or size). **Sands, Cements, Ganister.**—*Let us have your enquiries.*

THE CLEVELAND MAGNESITE & REFRACTORY CO., LTD.,
Normanby Brickworks, Normanby, Eston, Yorks.

SUBSTITUTES REFUSE, 3
OR YOU STAND TO LOSE.

"LINICORE"

Write for Sample and Money-saving quotation to
BARTOLINE (HULL) LTD.,
OIL REFINERS, HULL.

AN ordinary OPPORTUNITY.

300 tons of MOULDING BOXES,

including pipe and column boxes up to **28 ft. long**, and flat tops for covering up to **14 ft. × 8 ft** **Price £7** per ton, F.O.R. London. **NO ORDER TOO SMALL** Let me know what sizes you require as there are too many to print a List.

An EXTRAORDINARY opportunity.

JOBBING FOUNDRY,

well established, in S.W. London, for sale; owner retiring. Capable of 60 tons output weekly. 2-5 ft. drop bottom cupolas. 4-7 ton travelling cranes. A very well-equipped shop, personally inspected and recommended. **Price £2,500.** including buildings and fixed plant; no charge for goodwill.

ALEX. HAMMOND : BOXTED : SLOUGH.

PERIODICAL

THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON & STEEL TRADES JOURNAL

OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN

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Index to Advertisers, p 15 Situations etc., p. 20.

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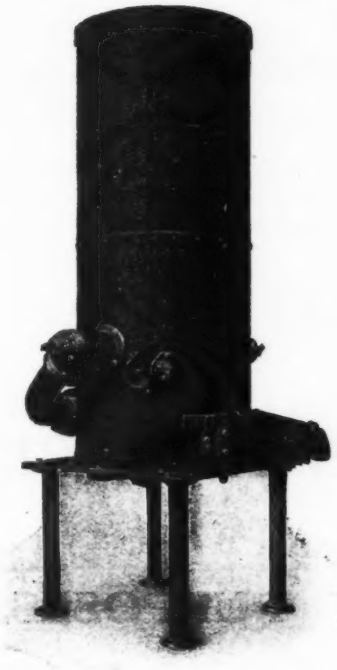
	No 1.	No. 3.			No. 4.			
		Soft.	Medium	Hard.	Soft.	Hard	Mottled.	White.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Iron	91.57	92.21	92.31	92.46	92.83	93.75	93.85	94.14
Graphite	3.25	3.00	2.98	2.90	2.95	2.60	2.00	0.60
Combined Carbon	0.18	0.23	0.33	0.45	0.50	0.60	1.50	2.80
Silicon	3.25	2.80	2.60	2.40	2.00	1.40	0.90	0.56
Sulphur	0.02	0.03	0.05	0.06	0.07	0.10	0.15	0.30
Phosphorus	0.80	0.80	0.80	0.80	0.72	0.70	0.70	0.70
Manganese	0.93	0.93	0.93	0.93	0.93	0.85	0.90	0.90

In addition to PIG IRON we are producers of the following :—

COAL for Steam, Gas and Household purposes.
LIMESTONE for Blast Furnaces and Foundries.
LIME for Building, agricultural purposes, etc.
SHOTTS BRICK for building purposes.

Foundry Plant



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Our 1922 Design DWARF CUPOLAS

for small Foundries, embody all the essential features of an Efficient Cupola without any Fancy Trimmings.

THE CHEAPEST, MOST RELIABLE & MOST ECONOMICAL CUPOLAS ON THE MARKET.

01. Cupola to melt 30 cwt. of Iron per hour.

02. Cupola to melt 20 cwt. of Iron per hour.

These Cupolas can be supplied complete with Positive Blower or Fan and also with a Hand-worked CHARGING MACHINE so that the Cupola can be operated by ONE MAN.

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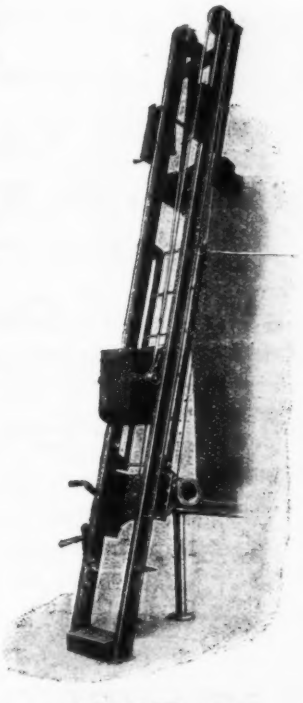
Also makers of Positive and Centrifugal Blowers. Steam Hammers, Drop Stamps. Centrifugal Pumps. The "Bradford" Patent Boiler Feed Pump.

Write for our new Foundry and Blower Catalogues.



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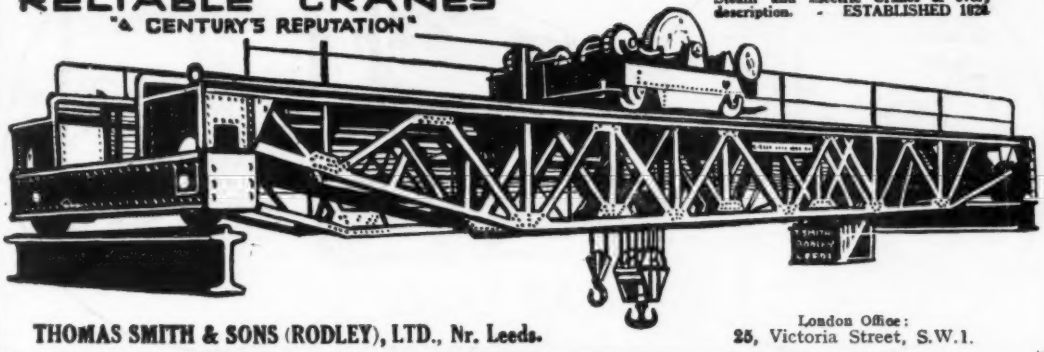

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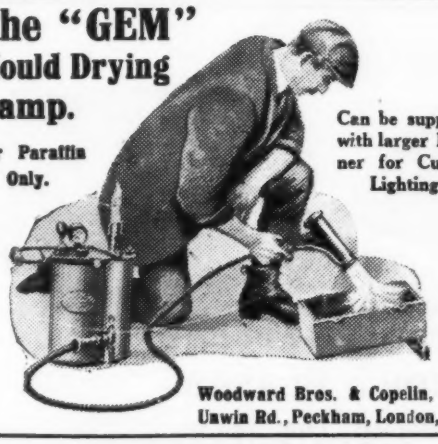

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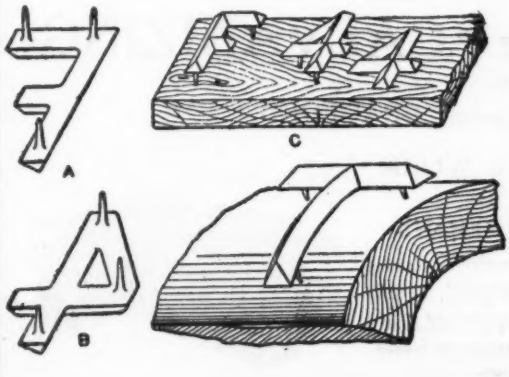

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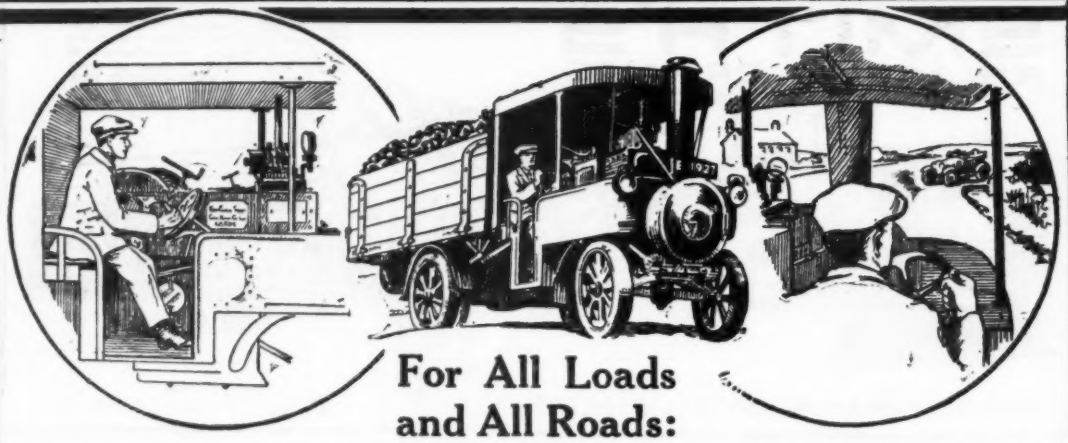

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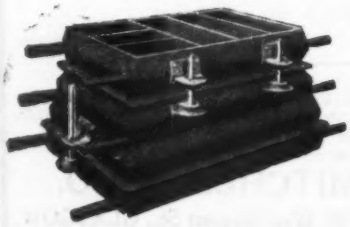

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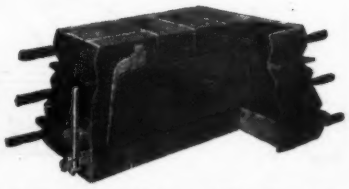
Rivetted, Oxy-Acetylene or Electrically Welded Metal Perforators. Pressings and Stampings.



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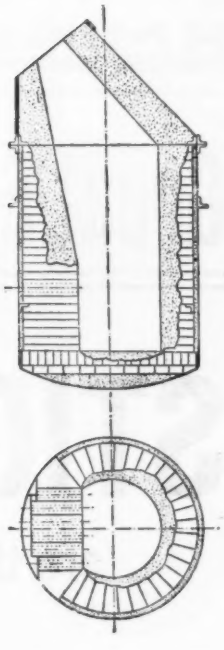
"Trade Mark Registered."

LET A TRUCKLOAD OF CUPOLINE PROVE THIS TO YOU.



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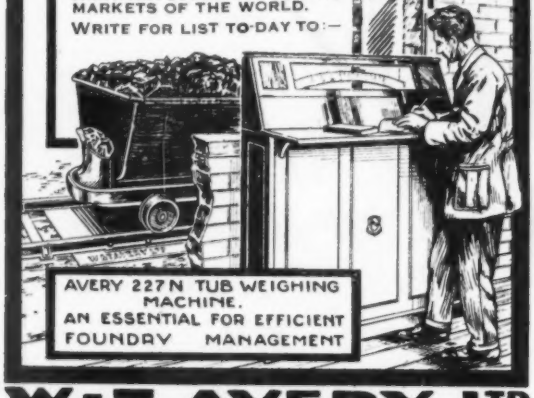

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AN ESSENTIAL FOR EFFICIENT FOUNDRY MANAGEMENT

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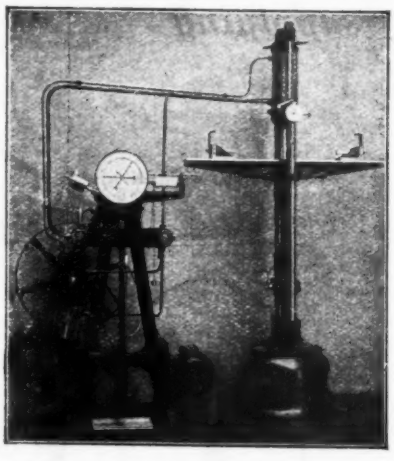

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Great Economy by Long Service

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are the most durable Brick for CUPOLAS

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FORDATH MIXING MACHINERY FORDATH MIXING MACHINERY

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STRONG — SIMPLE — EFFICIENT

ROTARY CORE MACHINES

Round and square cores from $\frac{3}{16}$ in. to 3 in. in diameter and 2 ft. long can be made from "Glyso" and silica sand alone by a child.

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We are, Sincerely Director.

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"The Hall-mark of Core Makers."

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SANDS

of exceptional merit.

NO. 2. **WHITE ROCK SAND.** Has a strong Kaolin bond. Is of proved value in ganister and other mixtures for lining cupolas, ladles, etc.

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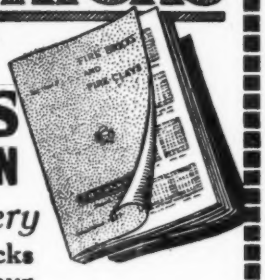

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Charging of metal finished 17 Cwt. 3 qrs. 12 lbs.
Ready to tip (after 55 mins. from start).
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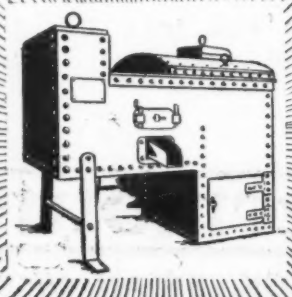
Charging of metal finished 11 Cwt. 3 qrs. 18 lbs.
Ready to tip (after 45 mins. from start).
424 lbs. Coke for 3629 lbs. metal.
1 lb. Coke to 8½ lbs. metal.



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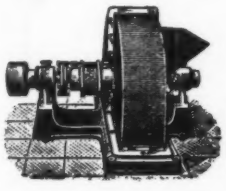

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INDEX TO ADVERTISERS.

	Page
Allan, Thos., & Sons, Ltd.	16
Amsler, Alfred J., & Co.	10
Armitage Works Co.	—
Aske, Wm., & Co.	12
Asquith, Wm. (1920), Ltd.	—
August's Muffle Furnaces, Ltd.	—
Avery, W. T., Ltd.	10
Baldwins, Ltd.	1
Bartoline (Hull), Ltd.	20
Baxter, W. H., Ltd.	—
Beardmore, Wm., & Co., Ltd.	—
Beecroft & Partners, Ltd.	21
Blackfriars Foundry Requisite & Equipment Co.	—
Brealey, W., & Co., Ltd.	15
Britannia Foundry Co.	—
British Reverberatory Furnaces, Ltd.	14
British Thermit Co., Ltd.	—
Brookes (Oldbury), Ltd.	16
Buckley & Taylor, Ltd.	—
Bullivant & Co., Ltd.	—
Butterworth Bros., Ltd.	16
Cammell, Laird & Co., Ltd.	—
Carbic Ltd.	16
Clay Cross Co., Ltd.	30
Cleveland Magnesite & Refractory Co., Ltd.	20
Collin, A.	—
Colville, D. & Sons, Ltd.	21&30
Consett Iron Co., Ltd.	1
Constructional Eng. Co., Ltd.	—
Crispin & Co.	—
Crosby Valve & Eng. Co., Ltd.	22
Cumming, Wm. & Co., Ltd.	—
Davidson & Co., Ltd.	17
Davies, T. & Son	—
Denby Iron & Coal Co., Ltd.	3
Dearman, E., & Sons	—
Dixon Crucible Co. (The Joseph)	—
Dowler, H. J.	—
Dudley Docker	1
Dudley & Dowell	—
Durrans, J., & Sons	—
Dyson, J. & J.	—
Evans, J., & Co., Ltd.	—
Findlay, A., & Co., Ltd.	—
Fordath Engineering Co., Ltd.	11
Foster Bros., Ltd.	26
Furmston & Lawlor	26
Fyfe, J. R., & Co.	—
Gadd, Thos.	—
General Refractories Co., Ltd.	27
Gibbons Bros., Ltd.	22
Gibson, Arthur L.	15
Gillott, J., & Sons	—
Goldendale Iron Co., Ltd.	—
Gossell & Son, Ltd.	—
Grandidge & Maasergh	—
Gray, Thos. E., & Co.	—
Great Central Railway Co.	—
Green, George, & Co.	—
Grundy, John, Ltd.	—
Guest, Keen & Nettlefolds, Ltd.	—
Hall, C. E. V.	24
Hall, J., & Co. (Stourbridge), Ltd.	19
Hall, Lewis & Co.	28
Hall & Lund Bros.	17
Hammond Alex.	20
Harper, Wm., Son & Co.	—
Harris Bros. (Brierley Hill)	4
Harvey, E. W., Gas Furnace Co., Ltd.	—
Hawkins, W. T., & Co.	—
Hingley, N., & Sons, Ltd.	29
Hope Works Co., The	—
House, Fredk., & Co.	24
Hunt, F. L., & Co.	29
International Abrasives Ltd	—
Jacks, William, & Co.	19
Jacks, Wm., & Co., Ltd.	—
Jackson & Brother	26
James, Wm.	27
Jones, Geo., Ltd.	27
Jordans Ltd.	—
Keith (James) & Blackman Co., Ltd.	—
King Bros. (Stourbridge), Ltd.	—
Lawson, Walton & Co.	24
Le Personne, L., & Co.	—
Leys Malleable Castings Co., Ltd.	—
Lilleshall Co., Ltd.	—
Lloyds Ironstone Co., Ltd.	—
Longrigg, F. T.	—
Longden, G., & Son	—
Lowood, J. Grayson, & Co. Ltd.	17
Lucas Furnaces	—
Lucy, L. H., & Co.	—
Lysaght, John, Ltd.	—
McGregor, Wm.	26
Macnab & Co.	—
McLain System (Inc.)	—
McNeil, Chas., Ltd.	23
Manchester Furnaces, Ltd.	—
Mann's Steam Cart & Wagon Co., Ltd.	8
Mansfield Sand Co.	—
Marley Hill Chemical Co., Ltd.	—
Martin, Wm., Sons & Co.	—
Mitchell, C. H. W., & Co.	7
Moenich, O., & Co., Ltd.	16
Moorwood, Hedley & Co., Ltd.	2
Motherwell, Wm., & Co.	—
Necol Industrial Collodions Ltd.	27
Newcastle Alloy Co., Ltd.	25
North Lincs. Iron & Coal Co.	—
Parkgate Iron & Steel Co., Ltd.	—
Penman & Co.	—
Perry, Thos., & Son, Ltd.	24
Phillips, J. W., & C. J.	—
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Pickford, Holland & Co., Ltd.	7
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Potter, Cowan & Co.	—
Primrose, T. J.	10
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Pneulec Machine Co., Ltd.	—
Ralston, Leonard	—
Ritchie Hart & Co.	—
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Roberts, Wm., & Son	25
Robson Refractories, Ltd.	9
Roper, E., & Co.	—
Rowat, Alexander & Co., Ltd	26
Sankey, J., & Sons, Ltd.	—
Sankey, J. H., & Son, Ltd.	14
Sheet Metal & Galvanizing Co.	8
Shelton Iron, Steel & Coal Co., Ltd.	—
Shore, Douglas W.	—
Shotts Iron Co.	4
Shropshire Iron Co. Ltd.	19
Sifco, Ltd.	—
Silent Machine Co.	21
Silica Société Anonyme	—
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Smith, Albert & Co.	—
Smith, Edward, Ltd.	1
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Spermolin, Ltd.	13
Standard Sand Co., Ltd.	1
Staveley Coal & Iron Co., Ltd.	6
Steel Co. of Scotland, Ltd.	30
Stephens & Co.	10
Stevenson, J., Ltd.	22
Stewart, D., & Co., Ltd.	—
Stewarts & Lloyds, Ltd.	30
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Thomas, G. & R.	—
Thwaites Bros., Ltd.	5
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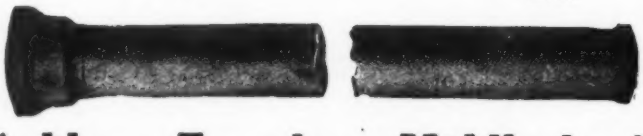

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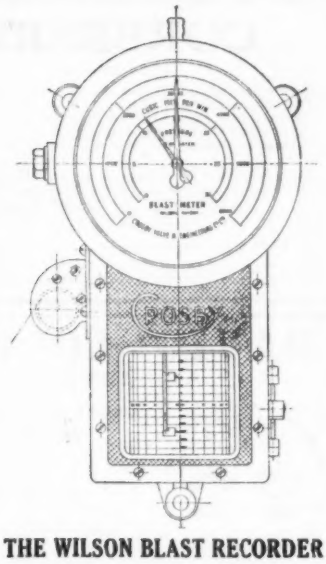

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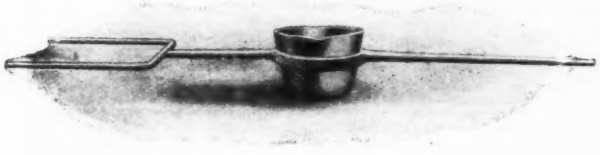

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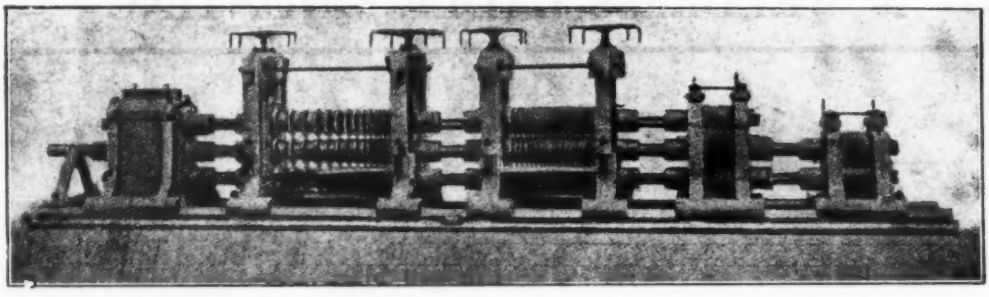

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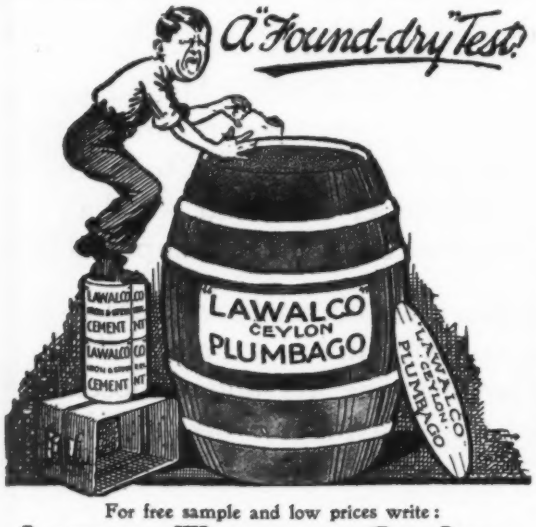

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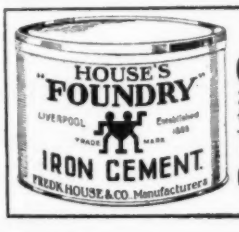

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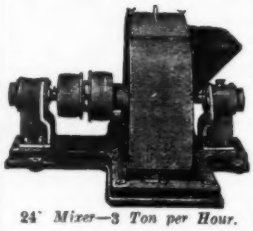

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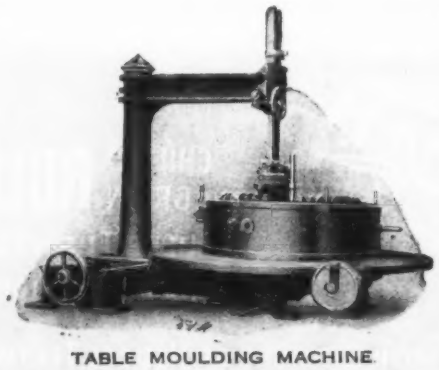

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